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ABSTRACT

This literature survey analyzes the process of industrial restructuring as it is occurring in the Republic of Korea, Japan, Singapore, and the United States. It looks in particular at how various agents of education and training in these countries--the school system, public and private education and training institutions and firms--are responding to the new and continually changing training priorities that are generated by structural change and technological innovation in the economy. The survey found that the primary agents of structural and technological change differ between the countries. The United States represents the extreme of relying almost exclusively on private sector initiatives and market forces in the restructuring process, whereas in Korea the government assumes the prime responsibility of facilitating adjustment to industrial change by economic and social policy measures. The study also found that in all four countries, there is a universal scramble for higher qualifications as a means to secure a good job. At the same time, many of the countries seem to consider that the output of the school system is inadequate to meet employer needs. The United States, however, has the advantage of a decentralized training system with strong links to employers, whereas the Japanese are successful with in-house training. The study finally emphasizes the relentless national drive for excellence in research and education that permeates the Asian countries' efforts, especially in the case of Japan. (KC)

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TRAINING POLICIES

Discussion Paper No. 18

EDUCATION AND TRAINING POLICIES AND PROGRAMMES TO SUPPORT INDUSTRIAL RESTRUCTURING IN THE REPUBLIC OF KOREA, JAPAN, SINGAPORE AND THE UNITED STATES

by

Janet Hilowitz

U.S. DEPARTMENT OF EDUCATION
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EXECUTIVE SUMMARY

This literature survey analyses the process of industrial restructuring as it is occurring in the Republic of Korea, Japan, Singapore and the United States. It looks in particular at how various agents of education and training in these countries - the school system, public and private education and training institutions and firms - are responding to the new and continually changing training priorities that are generated by structural change and technological innovation in the economy.

The primary agents of structural and technological change differ between the countries with the United States representing the extreme of relying almost exclusively on private sector initiatives and market forces in the restructuring process, whereas in Korea the government assumes the prime responsibility of facilitating adjustment to industrial change by means of economic and social policy measures, including education and training programmes.

The thrust of all the countries surveyed is to promote the growth of higher value added industries using advanced technologies. These industries require on average, a more skilled, educated and adaptable workforce than labour-intensive industries in Korea, Japan and Singapore and the so-called "smokestack" industries in the United States.

In all the countries studied, there is a universal scramble for higher qualifications as a means to secure a good job in the labour market. High school education has become a virtual sine qua non for entering the world of work. This is so, although by any objective standard the large numbers of labour-intensive and low-technology jobs in Korea and Singapore hardly require more than basic education. At the same time many of the countries seem to consider that the output of the school system is inadequate compared with its potential to develop technical and vocational skills and meet employers' needs for a literate, knowledgeable and adaptable workforce.

Education and training institutions often lack collaborative links with industry and enterprises. This perpetuates shortages of some skills and categories of manpower and surpluses of others. The survey draws attention to

the advantages of a decentralised training system such as that of the United States, which exhibits strong affiliations between training schools and colleges and industrial firms. Such collaboration tends to ensure quick articulation of training needs and a rapid response of training institutions and programmes to satisfy these needs. The Japanese system of relying on in-house training in large-sized firms also seems to guarantee quick adjustment of education and training programmes to meet new requirements for skills and qualifications.

The study finally emphasises the relentless national drive for research, development and educational excellence which permeate the Asian countries efforts to restructure and modernise their economies. An important factor in this process has been, particularly in Japan, the individual's desire and ability to "learn to learn", fostered by the cultural environment and the education and training system.

Education and Training Policies and Programmes to Support Industrial Restructuring in South Korea, Japan, Singapore and the United States

Introduction

The present report studies the processes of industrial restructuring in four countries - South Korea, Japan, Singapore and the United States - and the education and training policies and programmes that have been put in place to support them. Each country is presented individually, following a format which divides the material into five parts. In its general outline, each part describes first the industrial restructuring process and subsequently discusses education and training.

A more detailed description of the five parts is as follows. Part 1 contains a brief introduction to industrial restructuring, including the governments's role. Part 2 covers the labour market effects of the restructuring process, and sources of labour force adjustments. It then discusses the skill and knowledge implications of restructuring. Part 3 presents the existing education and training policies, first those of the government and then those of the enterprises and the trade unions. It also discusses issues such as the retraining of older workers and the national attitude and worker receptiveness to change and innovation. Part 4 presents an assessment of the effectiveness of education and training in light of the country-specific restructuring process. Finally, part 5 presents conclusions and some recommendations for further research.

With minor modifications, the format above has been followed for all four countries. It will be apparent that each country is not covered in the same detail for each part of the report. For example, in the Asian countries there is less information about trade union inputs into training, and more information about government's role. The differences from one country report to another depend upon the situations existing in the various countries, and also to some extent upon the material available.

A word needs to be said about the kinds of information used for this report. It has been drawn up almost entirely from written sources, with only rare input from individuals who are personally familiar with one or another aspect under study. It is based largely on ILO reports, government documents, sectoral studies, and technical articles. An attempt has been made to incorporate as painlessly as possible within the body of the report some of the important technical material usually presented in tables. For detailed breakdowns of items like attendance at various kinds of vocational schools according to programmes of study, the reader will have to consult the original sources.

A brief word about what industrial restructuring is may help here to better identify the subject matter of the report. In all advanced industrial societies, industrial sectors come and go; some sectors flourish in one historical period, some in another, depending on a large number of economic and other forces operating to favour or disadvantage them. Within each sector, the same variation over time is also true of particular industries. Recently, however, the number of industrial nations has increased, as has the number of industrial sectors and the kinds of industrial endeavours existing within any particular nation. On a world scale, this means increased production of sometimes similar goods, and if a country participates in world trade, it also means increased international competition. Likewise, there has been an enormous proliferation of industrial processes, and an even greater increase in the technical sophistication of the means of production.

Industrial restructuring is the conscious and planned response of firms, industries, or whole industrial sectors to changes in the climate in which the industries must operate, both domestically and internationally, and also to changes in the technology available with which to operate. In order to respond to forces such as larger and fiercer international markets, rising production costs, future inflationary expectations, raw materials constraints, machinery and industrial process innovations and obsolescence and a host of other factors, industries take steps towards their own restructuring. Often they are aggressive measures intended to position the industry for future growth once the changing "outside" forces have been taken into account.

Industries which pursue a posture of self-defence are usually older, mature industries using uneconomical production techniques, for whom the costs of full scale modernisation would be prohibitive. Often, self-defence

involves the search for less costly labour to continue production with present techniques. This may involve relocation. Other solutions are discontinuance of the industry, or the partial upgrading or automation of the production process in an effort to reduce labour costs. Industries which choose this second route - the upgrading of the industrial process - are joining the more aggressive industries in the use of more sophisticated technology to replace human labour. The more aggressive industries, however, will automate more fully and with state-of-the-art computerisation. They will set up new plants with much smaller, and much changed, human input. They may also relocate, on occasion, moving closer to or directly into their overseas markets. They will set up special training programmes and other personnel policies in order to attract and retain the most knowledgeable and capable workers. Many other personnel policies will follow, but they do not concern us in this report.

Virtually all the decisions mentioned above, and many more, have human consequences. More specifically for our purposes, they have education and training consequences. All workers need education, and the kind and level of education they obtain is important for employers. It dictates what effort the employer must additionally make in terms of training, what additional training the employer can expect from post-secondary educational and technical training institutions. And in situations of plant closure or industrial relocation, the workers displaced and left behind must be retrained for other kinds of jobs in the economy. Young poeople about to embark upon work must also be trained, and it is important that their training be as up-to-date as it can possibly be, to avoid rapid knowledge obsolescence. Older workers within the enterprises being shifted from one part of the plant to another in the course of restructuring, or those expected to learn how to deal with automated proesses, must be retrained for technological change. These are some of the important kinds of training needs implied by industrial restructuring.

The reader will note that the countries reported upon in the pages that follow have dealt with these requirements differently. The principal difference is between the Asian countries, on the one hand, and the United States in the other. It should be recalled that of all the countries studied, the U.S. has the longest history of industrialisation and also of restructuring. It also has the highest unemployment rate and by far the most difficult human problems to deal with as a result of the restructuring process.

Education and Training Policies and Programmes in Support of Industrial Restructuring in South Korea

Introduction

An examination of South Korea's economic development and of its education and training policies and programmes brings into focus the government's promotion of both industrial restructuring and an exensive education and training network to support it. The main impetus for this two-pronged initiative has been the strong national desire to remove South Korea from among the ranks of the poorer developing countries and place it among those in rapid development, principally Japan. In South Korea, restructuring has involved an earlier phase of introducing new industries and in fact whole industrial sectors which did not previously exist, with a second and later phase characterised by the upgrading of existing industries. This second phase is still in progress.

The following pages begin with a desription of the restructuring process and of the government's role in promoting South Korean economic development. Then the effects of this restructuring on the labour market and some labour force adjustments are examined. We turn next to the education and training policies and programmes aimed at promoting the restructuring effort. The leitmotif throughout, in South Korea's case, has been extensive government planning and intervention, as the following description will emphasize.

1. Industrial Restructuring: Causes and Strategies

1.1 The industrial restructuring effort

South Korea's development is often referred to as "export-led", although export promotion only became the dominant economic policy after 1967. Earlier, sources of growth consisted mainly of agricultural and manufacturing activities geared to the domestic market. Investment priorities changed frequently, as did the "production mix". It has been argued that the Korean economy moved rapidly through a succession of overlapping stages in the last twenty years (with) different manufacturing sectors growing at different rates

(and) with wide differentials in labour productivity changes.[1] Emphasis shifted from agriculture (1961-66) to export-led labour-intensive manufacturing (1967-71) to heavy and chemical industries for import substitution (1970s) and thereafter combined both heavy industry and exports. Today, in the mid-1980s, the economy still depends mainly upon exports and the heavy and chemical industries.

A real "take-off" did not occur until the mid-1970s, but already by 1978 a slowdown had begun. Inflation resulted from rising wages and increased purchasing power but insufficient goods, while an overvalued exchange rate and the contraction of domestic credit led to a recession and a decline in exports. South Korean exports are presently being challenged by cheaper products from lower-wage countries (Malaysia, Sri Lanka, the Philippines). South Korea has responded by attempting to increase the skill and knowledge content of its products.

The South Koreans have had a remarkable national drive for development. "The population at large was prepared to make sacrifices in the long term interests of the nation in the same way that individuals were prepared to saddle themselves with enormous debts so that their children could gain a better education and thus a better life".[2] Other important factors have been import bans to encourage substitution industries, government lending and investment incentives; interest rate policies; overseas export marketing centres; and the liberal availability of unskilled and semi-skilled workers who were initially low-wage (although average per capita salaries rose from under $1000 to more than $4500 over a twenty year period). South Korea also had and still has a strongly centralised government and a strongly controlled labour movement which shares the national development concensus.

Some analysts feel that South Korea should now look more toward its 40 million-strong domestic market, and also curb its heavy industry concentration. Present government policies therefore include more credit for small and medium enterprises. At the same time, however, there will be less protection and more foreign competition in the domestic market.

New manufacturing investment is also dependent on imported technology, including automated machinery, equipment, and sophisticated processes. New demands are being placed on the skill and knowledge endowments of workers.

1.2 The government's role in restructuring

The importance of government policy and planning to South Korea's extraordinary development can hardly be overstated. The high growth rate has been the result of deliberate planning (the annual growth rate has been above 5.5% every year between 1962 and 1968 and has sometimes risen as high as 9.6%). Five year plans gave priority to different industrial sectors at different times - textiles, machine tools and shipbuilding being important instances. Structural reforms were achieved through a combination of macroeconomic measures, loans and incentives to private industry, and direct government investment in industrialisation (of which the Pohang integrated iron and steel mill - POSCO - has been called the most successful example). Government has been directly or indirectly reponsible for between sixty and seventy percent of investment, and continues to have a policy choice "as to whether it should give equal support to public enterprise, big business and foreign investment or whether it should intervene to sway the balance".[3] The government was a direct actor in industrial investment up to the time of the Fifth Plan (1982), when this emphasis shifted to social, technological and manpower development. When the government began to actively encourage automation, rapid productivity gains were made in a number of industrial sectors.

Tony Michell notes that "The Korean achievement is more in the nature of a satisfactory adjustment to changing problems and perspectives and in finding new ways to sustain growth when the tried and trusted ways seem to fail".[4] Hyung Sup Choi, author of a study of Korean technology development, writes that "Korea's industrialisation process was characterised by deliberate selection of a few strategic leading sector industries, concentrating on them for the pre-planned period, adapting and assimilating the technologies, maximising the experience gained from it by utilising it in the next phase of economic development, and proceeding to the next more sophisticated technologies".[5] Michell lists some features the South Korean government shares with Japan's: a strong leadership which emphasises industrial development and maintains its influence over various social sectors that have an impact on this development; a capacity for forward planning, which includes providing financing, infrastructure and often direction, and "controlling the financial system very tightly so that little money is wasted on conspicious consumption."[6]

The recent shift of government emphasis to a more laissez-faire posture and greater economic liberalisation has been important for education and training. In the 1970s the government was concerned with shaping structural change both across manufacturing sectors and within the economy as a whole. There is now an increased concern with labour productivity and technology; indeed, the latter is considered "the touchstone of industrial maturity and fundamental to the continuation of export-led growth".[7] Such concern implies an increase in both careful manpower planning and training in research and development to support technological advances.

2. Industrial Restructuring and the Workforce

2.1 What workers do, what workers know

2.1a What workers do: changes in the distribution of labour

Over one third of the South Korean population, nearly 15 million people, were listed as economically active in 1984. Roughly one half of them were working for others, and the rest were considered "self-employed", mainly in rural areas. The official unemployment rate is less the 5 percent.[8] In recent years the unemployed have fluctuated between 600,000 and 700,000, despite the creation of new jobs.

In the twenty years 1963-1983, the number of workers in agriculture has diminished from over 60% to under 30% of the active population, while the industrial workforce has expanded from 28.2 percent to 40.7 percent.[9] According to Dr. Jeoung-Keun Lee, many people who left the countryside for the cities in the early 1970s, but did not have the skills to work in industry, took tertiary sector jobs. They subsequently switched sectors and moved into industry upon acquiring the requisite education and skills.[10] Within the industrial sector, the heavy and chemical industries development plan, formulated in 1972, gave priority to machinery, vehicles, steel and chemicals. Electronics also grew rapidly since the early 1970s. However, consumer orientated industries such as textiles and footwear, which had originated earlier and now had lower growth rates, also continued to be a source of jobs.

Recent employment trends include both the continued contraction of the agricultural sector and, later, of manufacturing as well. Employment in the

manufacturing sector as a whole has begun to fall, and the tertiary sector is now hiring workers - some with considerable training - who cannot find jobs in industry. But Michell points out that tertiary employment may offer limited possibilities for many of these people, as "the services are already ripe for a massive re-organisation".[11]

2.1b What workers do: changes in occupations

An economy with 30 percent of the labour force still in agriculture can be said to be only moderately industrialised, and in fact South Korea's transitional situation is indicated by other workforce trends as well. For example, the number of young people at work has declined because more of them are attending school for longer periods. At the same time, women's labour force participation is rising. This is especially true of younger women under 25, who go to work in moderately skilled jobs in textiles and electronics. In 1980, these women constituted almost 20 percent of the labour force.

In addition to textiles and electronics, wearing apparel, electrical machinery and transport equipment are the dominant manufacturing sectors in terms of employment. Together, in 1981, these sectors employed over 100,000 people. However, employment in textiles, electronics, electrical machinery and industrial chemicals all contracted in the late 1970s. Growth sectors were plastic products, transport equipment, and shipbuilding and repair.

Most of these industries have experienced a rapid upgrading of skill and educational requirements for their employees in a drive to increase productivity. Productivity has increased in labour-intensive as well as capital-intensive enterprises. However, the life span of recent newcomer firms to South Korean industrial production has often been short; and, when the firms have survived they have tended to remain small. The average size of textile firms is 87 employees, even though total textile employment is such a large percentage of total manufacturing employment.

In some sectors production is now geared to more upscale products, and together with the drive to increase productivity this has resulted in greater automation. In electronics, with only 7.6% of the industrial work force in 1981, the factories are newer and more automated than in textiles. They are managed by males but the workforce is mainly female, so that while employment

in electronics grew by 900 percent in the 1970s, more than half the new employees were women. In the late 1970s this workforce underwent a reduction of 12,800 persons, again mainly women. This is because, like in Japan, the lower-skilled female labour force is easily replaced by new technology. The fact that there has been more innovation in the electronics industry is not fortuitous but instead the result of government policy choices. As early as 1969 this sector was perceived as a strategic export industry and received special government attention in an eight-year development plan.

2.1c What workers know: changes in the knowledge, skill and qualifications profiles of workers

Women who form the predominant part of the labour force in textiles, wearing apparel, rubber shoes, electronics and other manufacturing sectors have, for the most part, a middle school or high school education and no specific skill training apart from on-the-job learning. Many of them begin to work in mass production between the ages of 16 and 25, and they receive between 50 percent and 70 percent of the wages of men doing the same job.[12] In South Korea, the majority of women are found in low paid, low skilled jobs.[13] Some women go into the service sector, which offers them somewhat higher wages.

On the whole, "The Republic of Korea's development in as far as it has relied on export led growth has been based not on an adequate supply of well educated labour, but on an adequate supply of well educated young females" - by which is meant high school education. But due to the wage differential, "the rate of return to families educating a female has been approximately half that for a man". Despite this, the balance in employment is shifting "towards an older, better educated and presumably more experienced and therefore more productive labour force" since more and more of the graduates of primary and middle schools have had continued schooling.[14]

South Korea has, in fact, a large supply of high school graduates who appear to be overqualified (or misqualified) for many of the existing positions but who do not possess the knowledge and skills needed for more advanced technical, planning and research positions where the available openings exceed the supply of candidates. There is a poor fit between the

formal level of schooling achieved, the kinds of learning that takes place, and the kinds of positions filled and needing to be filled.

In addition, there is an "excess" demand for college-degreed job candidates which results from factors bearing little relation to an applicant's real skill and knowledge capabilities or the requirements of the particular job in question. The demand stems in part from the South Korean traditional cultural preference for education, and the related tendency of managers to "believe that the higher the level of formal education of a worker, the better will be his performance and productivity. Therefore, it is assumed that job-specific skills and requirements would be met by a higher level of formal education, rather by non-formal training".[15] There are few job opportunities for those with non-formal training, and there is no reward structure for such training.

As a result, many positions which could be filled by high school graduates go to college graduates, often inappropriately and sometimes with higher wages than such jobs would warrant. Kye-Woo Lee makes it clear that a family desiring to invest in training beyond high school for their offspring will tend to prefer formal schooling, namely college - if entrance can be obtained - to any other form of further training because of the financial and prestige returns to such an investment.

As an illustration of the above, in 1979 almost 40% of college graduates had non-technical and non-knowledge-orientated jobs, most of which could probably have been performed by high school students - although imputed insufficiencies of high school students in the area of foreign and national languages may have been an impediment. In 1979, 16.8% of college graduates were clerical workers, and another 5.5% were production workers. There is also "an unfortunate trend for more of the able young people to go into medicine, law and management than into science and engineering".[16] In 1979, only somewhat over half of all college graduates were in jobs which positioned them to contribute to the nation's technological development. As for high school graduates, they proliferate in production work; in 1980, slightly over half of all production workers had high school degrees.

Some observers, among them Dr. Jeoung-Keun Lee, feel that South Korea's progress owes more to its well educated work force than to its investment in capital and infrastructure. For many Koreans this education is mainly formal

schooling. Yet the skill and managerial requirements of certain industrial sectors can be expected to increase dramatically as the demands of the international marketplace influence Korean industrial restructuring.

The many ways in which the South Korean government and proprietary institutions have organised schooling and skills training will be described in Part 3. It might be mentioned here that there are nationwide, uniformly recognised requirements for specific jobs. No worker can become an operative without receiving eight years of schooling (i.e., completion of primary school) plus three months' to one years' training either at in-plant training institutes or on-the-job as an apprentice. Semi-skilled workers must have graduated from middle school and had one additional year of vocational training. They may then become skilled workers after 2 or 3 years of industrial experience and the successful completion of upgrading courses, which however,are very few.[17]

There is, moreover, a National Technical Certification System consisting of two tracks, engineer and craftsman, divided into 235 and 582 trades respectively. Up to 170,000 people per year have been obtaining certification through this system. 1983 revisions to the law regarding technical certification specify that those with certificates must undergo in-service training every five years, beginning in 1985. This will mean that approximately 40,000 persons per year receive advanced training.[18] But at present suitable courses for them appear not to exist, and we may assume that most upgrading will be on-the-job training.

The training and skill achievement of South Korean industrial workers must be considered in light of the demands placed on them by the process of industrial restructuring. The next section will take up this subject.

2.2 The skill and knowledge implications of industrial restructuring

2.2a The introduction of new technologies: skill and knowledge implications

Industrial restructuring is not a once-for-all occurrence in which a plateau is reached; it is a process of constant adjustment and readjustment. In South Korea's case, initial "restructuring" consisted mainly of introducing

industry in sectors where few or no industrial enterprises already existed. Now, South Korea has reached a genuine restructuring phase because many of these "new" industries are twenty years old.

Tony Michell places much of South Korean industry on the frontier between a stage which involves "domestic mastery of existing processes and technology licensing" and a subsequent stage where production occurs "at the frontiers of existing technology". Some companies are experiencing difficulties at the former stage. "Although the machines are available, the local staff have trouble getting the right level of operation to obtain a satisfactory rejection rate. The present level of rejection is unacceptably high".[19]

Other companies are creating or importing sophisticated automation technologies which will substantially reduce the work force, in cases even by a 10 to 1 ratio. The government encourages this automation, especially in export industries (microelectronics, fine chemicals, machine tools) where increasing productivity is the only way to stay competitive. As of 1983, however, South Korea did not appear on a British Robot Association list of countries with 100 or more reprogrammable robots in operation.

Industries producing for the domestic market are often dependent on imported components. However, technology cannot always be imported, for various reasons. Product quality also needs improving, especially in industrial sectors subject to intense foreign competition. The rate of technological innovation is uneven. In fact, the principal source on technological innovation in South Korea states that private industries there have not felt the need for technological development, that "even today some Korean companies do not see clearly that such a need exists", and that "Korean industry needs a general technological uplift. For this to happen, industry must break away from its old habits and start paying attention to the importance of technology in modern industrial society".[20]

Two kinds of training are particularly urgent in South Korea. One is the retraining of simple production workers for occupational change, because the demand for such workers is levelling and will probably decline with increased automation. South Korea will therefore find itself facing a displaced worker problem. The other kind of training, which may be more urgent, is imparting to young people a higher degree of technological proficiency and more years of

schooling. After 1990, the minimum schooling requirement for a technician will increase to sixteen years.[21]

This second kind of training must be intensively computer-oriented, if South Korea is to be able to compete on a world scale. Fundamental will be training in computer-aided design (CAD) and manufacturing (CAM) and the integrated manufacturing processes based upon them. "In the Republic of Korea, so-called technologists able to manage automated production systems will, by the beginning of the 1990s, constitute the strategic new workforce at the expense of craftsmen, the traditional core of manpower in labour-intensive industries.[22] Also, South Korea's most recent development plan, the Fifth Plan, called for the expansion of industrial electronics. Semi-conductors, computers and communications equipment are stressed more than consumer electronics.

It can therefore be expected, given these trends, that job-seekers will be pressured to acquire additional education and skill training, either through apprenticeship and on-the-job training programmes or by other means, and at least partly at their own expense. At the same time, the government is making arrangements for the advanced training of technologists, engineers and scientists to overcome the "serious shortage of qualified technological manpower".[23]

The social ramifications of this intensive upgrading of skills and knowledge will be to increase the already growing inequality of income existing in South Korea. Poorer families will have to withdraw from competition for better and more financially remunerative jobs because they will not be able to afford the requisite advanced training for their offspring. The shape of the knowledge, skill and income pyramids is destined to become steeper.

2.2b The introduction of new technologies: changes in company and work organisation and job content

The national government is offering increased financing for small and medium sized firms. It will also have to address the problems these firms have in finding - and paying for - the best technicians and managers; they have been priced out of the market by the sharp pay rises of recent years.

In 1979, for example, labour productivity increased by 15.5% but the wage level rose by 28.3%.[24]

Companies will probably look more to the government to set its seal on training and certification levels, as a way of being sure that the workers hired are properly skilled and schooled in the new technologies. Companies will also increasingly attempt to rationalise their production processes, and this will result in a lower demand for workers of average skill and competence, who will be obliged to seek work in non-technically-oriented areas if they do not obtain retraining for higher technology. Many may be forced into the service sector, where already some skilled workers are performing jobs below their abilities. Meanwhile, additional skill training after formal schooling ends will be perceived as the path to more secure employment, and there is likely to be great demand for advanced training courses.

Labour turnover, which is extremely high at present, may be expected to decline. At present, manufacturing operates with an annual turnover of between 52 and 72 percent of the work force.[25] As plants become automated, and workers are trained to control and oversee the functions of automation, they may tend to accept more job stability instead of "voting with their feet" as they now do because they consider pay inadequate. This decline in turnover may be aided by the enhanced status of scientific, technical and managerial personnel who will design a firm's automated systems and shape its future.

In the area of work organisation and job content, changes will depend largely on what kind of automation is introduced and principally whether computer-programmable automated systems are used. Relevant issues in this context are whether production workers will be engaged in planning or whether planning activities will be separated from execution, oversight and maintenance; whether there will be greater interdependence among workers in various planning and production activities; whether there will be a greater need for workers with conceptual skills or whether workers will simply monitor and maintain systems in operation; which knowledge skills are required in planning and production, etc. How these issues are resolved depends primarily on a given firm's products and processes, what kind of automation has been or is being introduced, and "the choices made by those who design and manage

automated systems (which will) have a profound effect on how these systems influence the work environment".[26]

According to Dr. Jeoung-Keun Lee, who is an authority on South Korean vocational training, "Many conventional machines and manufacturing techniques are being converted into programmable automation with the aid of computer technology" and he indicates computer-aided design (CAD), numerically controlled machine tools (NC), industrial robots, flexible manufacturing systems (FMS), and computer-integrated manufacturing (CIM).[27] However, in 1983 Kye-Woo Lee of the World Bank characterised the South Korean endowment as "relatively simple technology" with which other developing countries were rapidly catching up, so that the Korean economy "must develop those industries that adopt relatively advanced technologies", which are less efficient in the developed countries.[28] What these two experts are noticing is probably a variation across industries in both the present level of technology and in the efforts to introduce more technological sophistication. Because of a lack of detailed information, it is difficult for outside observers to accurately assess in full the implications of this technological shift for education and training, and therefore what South Korea's present manpower and training requirements actually are and what they are likely to be for the remainder of the 1980s.

3. Education and training policies to promote technological innovation and structural change

In this section we will discuss the education and training policies presently in effect and those planned for the future. Policies to promote industrial development and structural change rely on both education and training, and on policies formulated in these areas in the past and those now being conceptualised. We will take up the government's policies first because the government is the primary agent for education and training in South Korea.

3.1 The government's role: The education system and formal training

In South Korea, the schools are the main source of industrial manpower, and this includes the vocational schools - although vocational training also occurs in accredited private training programmes and in firms themselves. We have already pointed out how widespread general education has become; and even

in vocational schools (which are at high school level or above) and in some enterprise-based training schools, 30 percent of course time is given over to general education subjects at the government's insistence.

Training offered by the government is administered by a government agency called VOTMA, the Vocational Training and Management Agency. "The Republic of Korea is an example of a country in which vocational training, although still pluralistic in its delivery, is to some extent moving closer towards a monolithic system following the recent introduction of a strong tripartite umbrella organisation. VOTMA was set up in 1982 as a result of the passing of Presidential Decree No. 10750 and is responsible for research, development, training and testing aimed at the enhancement of the national welfare and national economy. To provide training facilities for graduates from secondary schools, VOTMA has prepared a programme of institutional training, in-plant training and work experience designed for the semi-skilled, skilled and master craftsman categories and involving occupational certification at each stage".[29]

The vocational training and certification requirements for various manufacturing occupations make a principal distinction between craft occupations and technical manpower. Craftsmen most often perform production-related tasks after receiving a certain amount of technical education or training, while administrative workers engage in professional work in technical and administrative fields.[30] A craftsman may have attended a vocational high school and then a public or recognised vocational training institute; a technician will have had specific vocational training or attended a technical high school sometimes followed by a junior technical college or even an engineering college.

Kye-Woo Lee defends high school education for craftsmen. "It would not be an excessive requirement for Korean craftsmen in view of the more sophisticated technologies being adopted by many business enterprises and the abundance of high school educated workers. The requirement of a high school education for craftsmen would also help Korean exports to retain their advantageous position in international competition. At present, general high school graduates already account for more than 70 percent of the trainees in the vocational training centres".[31]

However, while praising the greater flexibility that higher education offers, Lee criticises the vocational high schools, feeling that "since (they) should be the main source of craftsman training, it is essential that their quality be progressively improved. If the results of the National Technical Qualification Tests (the certification tests) are indicative of the quality of these schools, their practical training programmes are inferior to those of the vocational centres (VTCs). While almost all VTC trainees passed the Second Class Craftsman Tests in 1978, only 70 percent of the vocational high school graduates passed these tests".[32]

In fact, enrollment in vocational high schools, and junior colleges, is not up to capacity because employment prospects are not bright. Less than half of junior college graduates join the work force, "but this is far from meeting the target...evidencing that it does not respond to industrial needs in a significant manner".[33] Ten percent of the graduates of vocational high schools are unemployed (although elsewhere we find a figure of 16.5 percent for 1979.[34] Vocational high schools also suffer from high student-teacher ratios - as high as 58.4 percent - and from rote learning. General high schools also suffer from high ratios. A network of private tutors helps young people prepare for entrance to post-secondary institutions.

Post-secondary vocational training is offered by both public institutions and proprietary schools under VOTMA supervision. For reasons discussed earlier, the demand for advanced technical training can be expected to increase and that for craftsmen and skilled worker training to decrease. In the past, there has been a marked change from enrollment in non-technically-oriented post-secondary courses to technical education. "This radical shift (from the early 1960s to the mid-1970s) reflects the intense process of industrialisation and technological change that the country experienced in the intervening period".[35] In the subsequent period, from 1973 to 1981, the government trained 27,000 technicians and over 250,000 skilled workers through public vocational training programmes at 142 training institutes.[36]

The requirements for enrolling in post-secondary technical training have been upgraded, so that now a general high school diploma is demanded. "These higher entry requirements will ensure a higher quality of students who will increasingly be trained for high qualifications. As Korea is moving from a

labour-intensive industrial economy to increased capital and knowledge-intensity in industry, the group of craftsmen - in labour-intensive industry a quantitatively important manpower category - are expected to decline in importance in favour of "technologists" who will become the key manpower group, together with engineers, in managing and operating automated production processes, robots, etc.".[37]

Engineers and more advanced technicians are trained in four-year colleges, including a new Korea Institute of Industrial Technology for specialisation in robotics. The 45 engineering colleges are sufficient, Dr. Lee maintains, to meet the forecasted need for engineers up to 1991.[38] This implies an annual output of nearly 30,000 diploma engineers and over 6000 doctoral engineers by that year. The World Bank has been helping South Korea increase its advanced training capacity. US$ 100 million have been invested in the engineering education sector and an equal amount in the science education sector.

The Korean Government has invested - with outside aid - not only in a new institute of technology but also in several open technical colleges to train technologists. These will provide two more years of intensive training for graduates from the junior technical colleges who have trouble finding work. There are also facilities for doctoral level training in science and technology (KAIST).

Planned for the near future is the training of 15,000 "core scientists" and also an effort "to strengthen education in science and technology (which includes) measures to improve the links between higher educational and training institutions, research institutes and industry. Engineers and scientists from research institutes and industrial firms will be encouraged to serve as associate professors and give special courses, direct graduate research and assist in curriculum planning".[39]

While the governments of many countries have established research bodies to promote R & D for industry and "to encourage industry to undertake its own research, the case of the Republic of Korea is instructive since there the government has - perhaps more successfully than others - managed to make research organisations responsive to industrial and market needs. It has also succeeded in getting higher educational institutions to turn out graduates specifically for industrial research and innovation".[40]

One example of such a R & D institution is KIET, the Korea Institute of Electronics Technology, founded in 1976. This is "an industrial research institute supposed to be working at the leading edge of manufacturing. KIET maintains a branch institute in Silicon Valley (in the United States) in order to keep abreast of the latest developments".[41]

There is also special science and technology training at the junior college level, and short courses for technicians and engineers covering the electronics field. The loans given by the World Bank to strengthen science and technology education were made in the expectation that by 1990 there would be an annual supply of over 400,000 graduates (of high school level and beyond) in these disciplines.

3.2 Industry's role: The enterprise in education and training

Besides the government and the proprietary institutes, the only other important actor in providing training is the firm. In matters concerning education and training, there appear to be no inputs from trade unions or workers' associations. And both proprietary and enterprise-based training are closely overseen by the government agency, VOTMA.

There are 231 in-plant training centres, training some 60,000 workers a year. Most of these centres were set up after the levy system was introduced in 1976. At that time, all firms with more than 300 employees were obliged by law to provide some enterprise training. "Although largely autonomous, these in-plant centres must still present candidates for national technical qualification tests for official recognition of attainment. In addition to the independent centres there also exist 42 joint training centres, where smaller enterprises have grouped together to reduce overall costs."[42]

The enterprises training institutes have turned out over 600,000 trainees since 1967, and private accredited institutions another 117,000.[43] However, a publication of the Korean Ministry of Labour points out that much of this training is low-level, teaching simple trades or producing "single skilled workers" - Class II Craftsmen and Assistant Craftsmen.[44]

These courses are principally for new employees, and there appears to be little continuous training or retraining of adult workers. Although Kye-Woo

Lee writes that "vocational training (has become) one of the essential activities of business enterprises", the firms do not yet "take the initiative in carrying out a vocational training programme for improving the quality of their workers".[45] While in theory enterprise-based training has the advantage of responding immediately to changes in production process or technology, it is unlikely that a Class II Craftsman, for example, would actually have a chance to upgrade his skills or his job qualification.

Continuous training - acquiring new skills or knowledge to upgrade professional capabilities during a lifetime - is therefore not an activity of importance in South Korea. Similarly, older workers who might be rendered unemployed by technological advances or industrial restructuring are apparently not perceived as a problem. The literature examined for this report makes no mention of either adaptation or displacement issues associated with older or more seasoned workers.

3.3 Attitudes toward change and innovation

The success of South Korea's present effort to engage in technological and knowledge-based restructuring of its industrial sector depends to a large extent on the receptivity of the workforce, and South Korea's workers are used to heavily labour-intensive production operation. Preparing attitudinally for change does not, however, appear to be a problem meriting particular attention. There appears to be no need for transitional support mechanisms.

But the actual introduction of state-of-the-art production technology is itself spotty, and perhaps the seeming ambivalence toward modernisation felt by some industrial management is also reflected in their unwillingness to acknowledge any potential adaptational problems on the workers. On the other hand, it may be that the attitudinal prerequisites for rapid industrial restructuring are already present, as evident by the shift of so many students to technical education.

One attitudinal change which has certainly occured is described by Dr. Jeoung-Keun Lee. He writes, "Not to go unnoticed among the changes that were made was the change of working ethics. The traditional master-servant relation patterned after the patriarchal family system was converted into the

modern version of employer-employee relations. This introduced a new working ethic based on egalitarianism and the freedom to choose".[46]

4. Assessing the effectiveness of South Korean training and education

4.1 How well do current policies and programmes support industrial restructuring?

It is clear that South Korea has made a massive effort to establish an education and training system which will buttress its attempt to industrialise and now to re-industrialise - in other words, to shift its industrial emphasis and priorities to meet the changing international competitive demands of the 1980s and beyond. Much of this effort has been described above. In what follows, we will concentrate on some of the shortcomings of this effort which may actually hinder the attainment of the goal of restructuring.

If we attempt to discuss these shortcomings in the order of their importance, perhaps what stands out most is the heavy emphasis placed on educational credentials rather than on a more pragmatic concern with a job candidate's range of skills and applicable knowledge. Therefore, job candidates with skill qualifications may be passed over in favour of those with advanced degrees (junior college or college, for example). Kye-Woo Lee, who is particularly critical of this tendency, labels it an "irrational factor" in hiring, promotion and compensation, and feels that the government should "launch a nationwide campaign to remove" this factor.[47] He also lists a number of other drawbacks to the full development of South Korea's effectiveness in vocational training, and his work should be consulted directly by anyone seeking details about this subject.

Here are some of his recommendations: There should be systematic programmes for upgrading employed workers; there should be an open education system - a system of non-formal education linked with the National Technical Qualification Tests, and courses should not be limited to industrial skills but should also include commercial and business skills; there should be continuous training opportunities for those already employed; there should be improvements in the quality of both high schools and the vocational training centres; and there should be a review of the effectiveness of the levy system which mandates enterprise-based training.

We have pointed out some of the particular problems of women workers in South Korea. Vocational planners are not taking full advantage of this sizeable and growing segment of the labour market. At present, women are consigned to do low-level jobs despite their large share of the workforce and their high school education. Moreover, they are not offered the training possibilities that men enjoy, and this is even more true of public institutions than of enterprises or proprietary institutions. Of all the workers trained in public training centres between 1978 and 1982, for example, only 18 percent were women, as against 25 percent of those receiving enterprise-based training.[48] Moreover, the fact that upgrading or continuous training is not offered by enterprises affects women disproportionately, since they do most of the lower-skilled work in the plants. And within the formal schooling system, what is taught "is sharply divided by sex, girls receiving home economics and boys technical subjects. Present plans of the Ministry of Labour are to establish new women's vocational training institutions. The question of opening the existing vocational training centres to girls instead of continuing the segregated training system needs to be considered".[49]

We turn, finally, to problems regarding management. In 1983, Kye-Woo Lee wrote that "the management style of Korean enterprises remains in the pre-modern phase and lacks a division of labour, specialisation, and a job analysis and description. Managers tend to assign workers without investigating the job requirements and matching skills and capabilities of workers. There is need to develop a rational and systematic personnel management system".[50] Tony Michell remarked upon "the inefficient way in which modern plant is operated", "problems of poor accounting techniques" and "the low level of managerial skills in the average Korean enterprise. That Korean business continues is therefore a reflection of low wages and very long working hours by both production and managerial staff". However, he also noted that the Korean Employers Federation and the Chamber of Commerce "believe that the recession of 1979-81 has led to a marked improvement in the management of Korean companies at all levels, with more attention being paid to manning levels and production organisation".[51]

4.2 Policies which can anticipate and prepare for change

Two important ways in which education and training policies can be tailored toward change are through manpower planning and through research and

development. We discussed above what is being done in the R & D area, and will now devote some space to manpower planning.

Manpower planning came into its own in South Korea in the context of the Fifth Plan (1981-85). The emphasis was placed on increasing the quality of vocational education; increasing the "fit" between the school system and the output of the training centres on one hand and industrial requirements on the other; and engaging in the forecasting of industry's manpower needs. These activities were to occur by strengthening the link between the training system and industry - although the only description in the literature of how this is meant to come about concerns advanced scientists and technicians in R & D institutes, to which we referred above. There is no other mention of institutionalised interaction among policymaking agents, which are chiefly the government, the vocational planning agency and the enterprises.

Other plans include the computerisation of the training, tracking and forecasting effort and the introduction of a strengthened system of vocational guidance for career choice, presumably based on the feedback of information obtained from manpower forecasting. The recommendations of Kye-Woo Lee which we listed in the previous section do not appear to be concerns of the vocational planners or administrators.

Dr. Jeoung-Keun Lee sees computerisation as a major step to greater training efficiency, and has written an entire pamphlet on this subject.[52] He also recognises the need for follow-up studies so that information about the labour market and the suitability of acquired skills can be fed back into the planning process.

In 1982 the government divided manpower planning into two parts, one agency being made responsible for highly trained manpower and the other for skilled workers. KVTMA, the second, is also responsible for skill certification and, in part, for placement services. "The involvement of KVTMA in overall stages of manpower development reflects the intention of the Korean government to ensure the consistency of manpower policy and the professionality of manpower development".[53]

5. Conclusions and recommendations for further research

The most important points in the literature in education and training for structural readjustment in South Korea are the following:

- the strongly centralised education and training system;
- the strong national drive to provide adequate education and training services to buttress economic development, combined with the shift in national priorities toward a more high-powered, knowledge-intensive type of industrial production which, however, will remain export-oriented;
- the substantial investment in both R & D and manpower planning, all within the last several years;
- the inadequate links between the needs of industry and the current training and education programmes;
- the absence of mechanisms for continuous interaction among policymakers (in this case mainly government, education and training institutions and industry);
- the failure to offer sufficient upgrading, retraining and continuous training services;
- and finally, the failure to offer adequate training and advancement facilities for women.

Any discussion of the above must take place against the background of substantial unemployment in South Korea in the past and the likely presence of future unemployment, even at higher skill levels. Computer-aided designs and the type of one-man-operated automated plant now evolving in Japan may eliminate much well paid employment which traditionally required highly skilled labour.[54]

South Korea therefore finds itself having to encourage rapid automation, and the technological training to support it, in order to compete with other

NICs in capturing markets formerly destined for developed-country exports. This appears to be the wave of the future, but it places the nation in the unenviable position of creating unemployment at the same time as greater industrial sophistication and well-being. The forward planning badly needed in this conjecture appears not to be forthcoming. Nor does any managerial upgrading seem to be occuring, except perhaps as the by-product of experience or "learning the hard way". These issues need further research, as does the input of various economic agents (government, labour organisation, industry) into the planning of training and the training process itself.

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Education and Training Policies and Programmes to Support Industrial Restructuring in Japan

Introduction

Japan's industrial economy has been undergoing major changes for over fifteen years, although recently the number of industrial sectors concerned has sharply increased. Indeed, many observers have remarked that Japan may now be in a transformative phase of historic magnitude.

Virtually all of Japan's extraordinary development has taken place since the Second World War. By the mid-1970s, Japan had achieved average annual GDP growth rates of 10 percent, thereafter maintaining average growth rates of 5 percent. Japan had few of the important raw materials upon which most nations base their development, and it was also dependent upon imported energy. Yet its development weathered two world energy "crises" in which oil prices skyrocketed (1972 and 1979).

Two strongly positive features of Japanese development stand out. Japan had, in the early years, a large pool of young and well educated workers. It also had a political consensus which gave a great deal of importance to national growth. In the first years of development heavy industry was emphasised, along with textiles and the petrochemical industries. Since then, Japan has become world famous for its high quality microelectronic products. The willingness to borrow and adapt technological innovations from elsewhere was combined with managerial attitudes and a cultural ethos facilitating the "rational" use of both technology and labour. Many Japanese products were exported abroad, since the domestic market was neither large enough nor sufficiently consumer-oriented to absorb the ever-increasing production.

We will turn now to a discussion of the restructuring process and its various characteristics.

1. Industrial restructuring: causes and strategies

1.1 The industrial restructuring effort

Numerous books and articles have been devoted to the Japanese economic miracle and the recent problems which have beset it. They all appear to be in broad agreement about both events and interpretation. The only areas as yet little dealt with have been the crises of the automobile, electrical and electronic industries, which are perhaps too recent to have been fully digested in their impact and implications.

The direct causes of the automobile crisis are the U.S. request for "voluntary" Japanese import quotas for the United States, Japan's major market, and the over 40 percent appreciation of the yen since September 1985 which has made Japanese cars dearer abroad. In the last few years, many Japanese products have also become uncompetitive against a flood of new manufactured goods from Korea, Taiwan and Malaysia, where wages are also lower. This is not the case for the automobile, except for the Hyundai manufactured in South Korea. Annual GDP growth which as recently as 1984 was 5.7 percent in real terms, was expected to drop as low as 2.3 percent for the fiscal year ending in March 1987. Some car manufacturing operations, and also other industrial operations, were moving offshore with government encouragement. In the car sector, solely owned or joint venture operations are increasingly maintained directly in the U.S. in order to circumvent import regulations. This has not prevented a "shake-out" from occuring in both car manufacturing and electronics - a situation we will return to later.

Most of the early restructuring took place during the 1970s as a way of meeting the energy crises and protectionist threats in Japan's overseas markets. The choice was made to shift more toward energy and labour-saving products and technologies. "By 1978...Japan had built an industrial structure highly resistant to exogenous shocks, (with) import specialisation in raw materials and basic resources and export specialisation in sophisticated industrial products. (This meant) a great expansion of the branches of manufacturing which produce machinery, appliances, and instruments, which depended less on energy than the conventional heavy and chemical industries. The sophisticated exports carved out their own foreign markets based on the strength of this quality".[1] Japan also followed an industrial export

targeting strategy, counting on volume sales to compensate for the lower selling prices of its exports.

Japan shifted, then, away from labour-intensive, low-wage exports toward capital and skill-intensive goods so that its pattern of comparative advantage in world trade became similar to that of the other advanced industrial countries.[2] When protectionist threats intensified, Japan's industrialists not only shifted some of their investment directly overseas but also "cut back plans for expansion in certain mass consumer goods industries (and some capital goods industries, such as machine tools) (and) gave extra incentives to firms to move up-market" to products of such superior quality that they would be likely to offer a defense against protectionist measures.[3] In this way cars and consumer electronics became foremost among export industries until very recently.

The turn to knowledge-intensive, high value added industries with lower staffing requirements came in part from the prevailing expectations of business firms about where the future profits were likely to lie, "and those expectations, confirmed by initial experience, had a powerful effect on directing investment behaviour".[4] The government was also instrumental in encouraging this shift of investment emphasis. Japan reinvests earnings more than most other economies, private consumption is relatively low, and the banking system and other sources of industrial credit emphasize longterm success rather that short term profits.

Other characteristics which facilitated restructuring were the high degree of oligopoly among Japan's largest manufacturers, and the growing role played by unrelated satellite firms which supply components required for manufacturing operations. It was possible to shift intense competition toward these smaller firms, who vied in their pricing and delivery times in order to survive.

Japan also became a pacesetter in introducing factory automation, robotics, and office automation. Kenichi Ohmae, the head of the McKinsey and Company Tokyo office, finds Japan in the midst of three "revolutions": production, office, and technological. The latter includes microelectronics, bio-engineering, and new materials production.[5]

Japan's strategy of carefully channeling investment into those sectors most likely to succeed has resulted in a marked differentiation across sectors. "Some sectors of the Japanese economy are highly productive. Their performance is very impressive in both absolute and relative terms. However, other sectors are depressed. By depriving less-favoured market segments of capital, the Japanese have paid a price for their successes in industrial targeting".[6]

The industries defined as depressed under the terms of a 1978 "depressed industries" law includes textiles, shipbuilding, steel, and some chemical products. In textiles, plant closings and workforce reductions occurred during the period 1974-75, although the industry continues to exist because of automation and streamlining. Shipbuilding has been affected by global overcapacity and world recession.

The Japanese deal with industrial overcapacity and declining demand through the practice of "mothballing" - literally packing up excess plant so completely that re-utilisation would prove unprofitable. This is an alternative to total dismantling, since is means that the machinery is still available. This has been a voluntary step on the part of affected enterprises, but it has received strong government encouragement, as has the formation of depressed-industry cartels to decide which sectors of which industries should be mothballed. In shipbuilding, for example, part of older plant has been mothballed and the rest has been technologically updated in what Dore refers to as a "comprehensive rationalisation scheme". This rationalisation occurs in various industries in response to competition from the NICs, world recession, changes in relative energy costs, and general worldwide overcapacity. Dore writes of this process: "Whatever the source of trouble for the problem industries...the measures used to tackle (them) have been the same, and they have been rather more...thorough-going and closely planned with the whole industry whan in most other industrial countries".[7] The problems in shipbuilding have a long history. The sector underwent "far-reaching structural changes to adjust to the rapidly decreasing market", with a total displacement of workers "of monumental proportions".[8] At the end of 1986 it was predicted that "Japan is widely expected to be the site of the next big round of shipping bankruptcies".[9]

Some of the most recent competition in shipbuilding is likely to come from China. Yet it is partly because of the growth of the Chinese market that the steel industry had managed to continue its reasonable rate of exports. But employment in steel has fallen substantially - by almost 20 percent between 1974 and 1982. Since the second energy crisis of 1979, cuts in capacity have affected aluminium smelting, synthetic fibres, oil refining, petrochemicals, and chemical fertilisers and paper, among others.

Returning now to the two sectors most recently in difficulty, cars and electronics, the former stand out because of its earlier success; the car industry employs 10 percent of the country's workforce and generates more than 20 per cent of its exports. We have already mentioned some of the factors causing difficulties here. "The current problems are highlighting individual strengths and weaknesses. A shakeout or restructuring...may become inevitable...The damage is widespread".[10] The industry has already been extensively automated.

The electrical and electronics industry is the other major sector now obliged to restructure. How recent this imperative is is indicated by a Newsweek article of 9 August 1982 describing the vigour of Japanese E & E industries: "Japan has virtually wiped out international competition in consumer electronics...The country is also a leader in robotics and optical electronics. And Japanese industry is rapidly closing the gap with the United States in computers, semiconductors...". The sector was referred to in Japan as "the rice of industry", an accolade formerly reserved for the steel industry in the 1950s and 1960s.

But by 1985 profits had fallen drastically and the industry threatened employment layoffs – a rare way of reducing labour surpluses in Japan. The industry was "hit both by slacker demand for a wide range of durable consumer products and by sharply falling prices for integrated circuits.[11] Moreover, there are many producers, and the industry is ripe for a shakeout. Even the robotics industry is suffering from overcapacity; "robots are already unemployed".[12]

The high technology sectors remain, nonetheless, the focus of national commitment for the future, and Japan has plans to spend up to four percent of GNP on research and development as part of an ongoing industrial strategy" including computer aided design and manufacturing, flexible manufacturing

systems, machine tools, hardware and new materials technologies, and biotechnology. "This programme amounts to the most significant change in direction certainly since the Second World War, possible since Meiji. Up to 20 percent of Japan's GNP will be directed towards new technology industries".[13]

There is, then, positive change as well as the painful readjustment which characterises depressed or declining industries. There continue to be dynamic forces in the economy, and the rate of economic growth, "while much lower now than in the 1950s and 1960s, is still higher than the average for other OECD countries and likely to remain higher for some years hence...Japan's ability to restructure declining industries has been, and seems likely to remain, superior to that of other advanced countries. Japanese firms have considerable experience in moving resources rapidly from activities with declining potential to activities with growth potential...(and the) substantial pressure for disinvestment in a broad range of declining industry" will not profoundly affect the competitiveness of the economy as a whole. On the other hand, "Japan's experience with structural adjustment has been more successful than other countries' in part because it began to face major adjustment problems only in the past few years".[14]

Later we will discuss the employment, education and training implications of these changes. In the section below we take up the question of the government's role in promoting the restructuring process.

1.2 The government's role in restructuring

Much has been written about the exceptional degree of collaboration between the government and private industry, and some observers have admired this relationship for its effectiveness in facilitating restructuring. R.P. Dore remarks that "it is hard to define the role of the government in the field of industrial policy. Some commentators see in Japan a shining example of state planning, others reconfirmation of the virtuous nature of the free enterprise system". By and large, however, "the constriction of the power of free market forces by government regulation, by cartelisation, and by trade union and professional group monopolies is as marked a feature of the Japanese as of the European economies". Dore also points out that "the 'Japanese Government' is more like a federation of semi-autonomous ministries and

agencies...(it) does not seem highly organised and capable of speaking with one voice (but rather) works through pervasive consultations among government agencies, business groups, and labour unions and lacks a single central institution with the authority to legitimise and enforce the social contracts negotiated among them".[15]

The government is active in the area of industrial policy and "supplies incentives, both material and moral, for corporate decisionmakers to move in those directions" it desires.[16] It fosters a consensus about which industrial areas should receive increased investment and which should be discouraged from expanding. The government agency most directly responsible for the implementaton of policy is MITI, the Ministry of International Trade and Industry. MITI operates in accordance with an overall national economic planning policy "which deliberately gears resource allocation toward technological advance, energy saving, environmental protection, and...international competitiveness".[17] The assortment of measures used to reshape the industrial landscape include direct investment (240 billion yen over a seven-year period to build up high technology and quality products); other forms of financial assistance, including development credits and tax credits; technology import controls; and bank loans for capacity reduction. Cartels and industry associations exert powerful pressure upon individual industries in the interest of national development.

The government also funds R & D efforts at a cost of about $25 billion per year, and this expenditure is increasing faster than GNP. In 1983 parliament voted to create 19 new research and industry centres. Private industry is also increasing its allocations for basic research, and here again the government provides strong incentives for collaboration among industries, especially in the high-technology fields. In 1980, MITI moved to encourage the use of industrial robots throughout the Japanese economy, and directly sponsors research on robotics.

The government's role in de-activating the depressed industries has been even more central, especially in devising incentives for restructuring, even though "total expenditure on declining industries has not been large: the larger share of state funds for industry has been reserved for the growing ducklings rather than for the lame ducks".[18] Industries in difficulty seek recognition as "depressed industries"; MITI and the industrialists concerned

then draw up plans tailored to the specific circumstances. The government can support capacity reductions or provide worker assistance. For the textile industry, MITI encouraged overseas production; for shipbuilding, increased specialisation.

There may be some reason to doubt MITI's continued efficacy in the future "as still more basic manufacturing industries become less competitive (and) Japan's problems with declining industries...come to resemble U.S. and European patterns, in which the intractable issues are those of facing up to permanent declines in competitiveness, of retraining older workers, and of re-establishing stable employment opportunities in hard-hit regions...the whole process of structural adjustment in Japan is likely to become more difficult".[19]

2. Industrial restructuring and the workforce

2.1 What workers do, what workers know

2.1a What workers do: changes in the distribution of labour

Japan's total workforce numbers almost 55.5 million people. Over the past twenty-five years the labour force has not only grown by one quarter but has also massively shifted out of agriculture and into industry and services. In 1980, slightly over ten percent of all workers worked in agriculture, down from nearly one third in 1960. The service sector has been the primary beneficiary of this reduction; it grew by nearly 20 percent over this period while industry, mining and construction grew by only 4 percent. Today roughly one third of all employed Japanese work in industry, while over half are in services.

The sectors in which employment grew most were not necessarily those in which output grew most; output declined over the 1970-1980 decade in both services and government but employment increased.[20] In fact, these areas were taking up the slack from a steady decline in manufacturing employment since 1973 - despite the steady growth of manufacturing output. "...like other advanced countries, Japan is moving on to the stage of 'service economy'".[21] According to the Japanese census, "between 1970 and 1980 the number of blue-collar jobs in manufacturing and transport increased by only

330,000 as compared with an increase of 2,350,000 jobs in sales and services and 4,510,000 in office, research and development, and managerial employment".[22]

There is also a temporary labour market made up of workers who are part-time self-employed in agriculture and devote part of their year to working in industry or services; and of women who may work full time in industry but do not enjoy Japan's well known "lifetime" employment status with the major employers. These two kinds of workers act as a cushion for employers, and "many Japanese women workers...tend to move between employment and being out of the labour force...(Women may be considered) peripheral workers in the Japanese employment system".[23] Women do not receive equal wages with men and the average female wage is slightly above half that of a man. Dore points out that the flexibility attendant upon hiring women has allowed employers to introduce large amounts of automation without displacing long term male workers. Unwittingly, women have played a role in facilitating structural change.[24]

The national unemployment rate has hovered between two and three percent since the mid-1970s. In 1970, however, it was only 1.1 percent. Only as a last resort are long term, "permanent" male workers fired. There are, however, hiring freezes which sharply curtail the employment possibilities of new recruits from schools and universities, so that in times of downturn the age and sex distribution of the employed workforce becomes skewed toward the older male workers who have been faithful employees for many years. Younger workers who cannot find good jobs then take lower-skill, lower-paying jobs for which they are overqualified. Japanese firms also encourage very early retirement, and in some cases the redeployment of workers to other, related firms or subsidiaries.

The future outlook is for greater mobility, as early retirement opens up more positions in the major firms and may permit the access of qualified younger workers to the most dynamic developing areas of the industrial economy. It may also create more opportunities for promotion and merit rewards within the firm. At present, age, educational qualifications and seniority set limits on where and how far an individual may move in the plant.

It remains to consider briefly the effect of employment of Japan's heavy investment in automation. The findings from various enterprises are, as one might expect, negative: a 20 percent or more decrease in women and part-time - mainly female - workers; a decline of 40 percent in production employment, the affected personnel being transferred to other activities; a 60 percent overall decline in staffing among electrical and machinery workers because of microelectronics; reductions in overtime and shift work; the assignment to other tasks within the plant; and workforce decreases varying from firm to firm. Employment has risen only among microelectronics producers and chipmakers (not users). The Japanese have not liked to practice layoffs, preferring reassignment, but "there are signs that this practice...may be changing. Recently there has been evidence that Japanese workers are becoming more concerned about the impact of new technology on employment (and) unions have begun to win agreements aimed at protecting workers against the potential negative effects of automation".[25]

2.1b What workers do: changes in occupations

In what follows, we look a bit more closely at the manufacturing sector and the employment changes in various industries in recent years. The increase in manufacturing output and the decrease in manufacturing employment have already been pointed out. In the twelve year period between 1970 and 1982, the five net employment loss industries were textiles, lumber, rubber products, iron and steel, and machinery; the three net gain industries were electrical machinery including electronics, transportation equipment, and precison instruments. In the same period, there was also an employment rise in retail and wholesale jobs and in service jobs.

Using 1975 as a base year, by 1980 the index of employment in textiles had dropped from 100 to 89, in shipbuilding from 100 to 63, and in steel from 100 to 84.[26] Expected job losses in the future include some 7,000 positions in shipbuilding, some 40,000 in steel, and some 11,000 in coal mining.[27] In the television manufacturing industry, total employment fell from 48,000 to 25,000 in the early 1970s, despite a 25 percent increase in output in the same period. In the electronic consumer goods sector as a whole, it fell by 31 percent.[28] In the car industry, the introduction of microelectronics discouraged any employment expansion in the early 1980s despite a continued rise in production.

We learn from the 1982 Annual Report of the Labour Force Survey that between 1975 and 1982, the number of men who were craftsmen and production process workers declined slightly, to one third of all men employed; the number of women in this job category held constant at 22 percent. Looking at some other kinds of jobs, here are 1982 data on occupational distribution:

Professional and technical workers: under 10 percent, both sexes, but slightly more women than men and increasing for both sexes;

Managers and officials: around 6 percent, all male, not increasing;

Clerical workers: nearly one quarter of all working women, and growing; only 12 percent men and constant;

Sales workers, both sexes: about 15 percent of the workforce; growing, especially for men;

Service workers: relatively constant at 6 percent of the male and 12 percent of the female workforce.

2.1c What workers know: changes in the knowledge, skill and qualification profiles of workers

The professional and technical workers category has been growing faster than any other, and the overall number of production workers has been declining. Undoubtedly this dual shift has to do with the intensification of growth in areas of high technology. Office automation will also raise skill requirements, so that the clerical and office workers will need to update their technological knowledge.

Many educated graduates have been emerging from Japanese universities, and there is a shortage of positions for them. This is combined with a general decrease in the numbers of young people as a whole, and the rapid aging of the Japanese population. There is thus a reduced supply of blue collar workers, at the same time as there is an "oversupply" of college and university graduates. "Corporations have less room for university graduates at lower career ladders - as recently as 1977, only one in six graduates went to the biggest companies...In the big companies university graduates are being

pushed into new jobs such as sales, hitherto reserved for less educated personnel. Smaller firms are hiring more university graduates from the better schools, thus reducing the pay differentials between big and smaller firms for some types of jobs".[29]

The impressive qualifications of the young people entering the companies, combined with the fact that many retiring workers are unskilled, means that "at the recruitment end and the retirement end, the (unskilled) labour supply is drying up. In the middle is a growing pool of young educated workers with higher expectations and salaries facing lower promotion prospects for supervisory and managerial positions...Japan is far ahead of many industrial competitors in the level of educational quality and quantity of skills".[30]

The same trend has affected Japanese women, who now participate more in the labour force and also have a high level of education, often including university. However, "as in other countries, Japanese women will be concentrated in the low paying job sectors, with a major pay differential between men and women". And women will continue to be denied entry into managerial levels of responsibility, which are considered "the traditional male preserve".[31] Women's intelligence is rarely rewarded by appropriate job offers.[32]

What will be the long run effect of this mismatch between skills and jobs? It is unclear exactly how serious the mismatch is. "Some analysts have argued that the changing demographics will cause employee resentment with work, as fewer promotion opportunities arise and the mix of low skilled jobs and high levels of education increases the conflict and discontent".[33] However, "the average skill attainment of the Japanese engineering graduate may be below the average in some competitor countries ...Graduates seek to enter manufacturing industry, which has status. In 1982 70,000 of them did so, and almost 20,000 went into the construction industry. These are massive figures by any standards".[34]

Other figures confirm the higher level of schooling of labour force entrants and the late stage at which they begin their first real job. Between 1960 and 1982, the proportion of school leavers receiving some form of post-compulsory (i.e., post-lower secondary school) education increased from 52 percent to 95 percent, and the average age of new workers increased from

sixteen and a half to nineteen years (for combined "skilled manufacturing plus engineering" jobs) and from seventeen and a half to twenty years for all jobs.[35]

2.2 The skill and knowledge implications of industrial restructuring

2.2a The introduction of new technologies: skill and knowledge implications

The impact of the introduction of new technologies on skill and knowledge requirements is not unlike that found elsewhere in advanced industrial countries. The requirements for larger numbers of technically trained personnel have increased, and - as already pointed out above - more technical personnel and engineers are actually being given post-compulsory schooling. At the same time, the new technologies tend to displace workers.

The Japanese have so far managed to deal with this displacement by transferring the redundant workers to other units of the company, usually in the same branch of industry since conglomerates do not exist in Japan. However, this transfer, which is increasingly frequent, may render their acquired skills obsolete and necessitate retraining for new activities within the plant. Two characteristics of the Japanese industrial system and its relation to education aid in this process. First is the fact that most training has, initially, been carried out by the manufacturer or firm itself. Second is the broad and generalised education most workers have received at school. Both of these features help the worker's ability to learn a new industrial activity, as does the "lifetime" employment contract which offers a certain job security to some 13 percent of the total workforce, all male.

The degree of technological innovation in some plants is quite thorough-going. The semi-conductor industry is one example. "Back in the early 1970s, before the energy crisis, all 'clean room' operations...were almost entirely manual. Just after the energy crisis, facilities began to be semi-automated, and today they are almost fully automated...The silicon wafer is inserted at one end and a completed chip comes out the other...Automated plants are setting the pace for the industry. Hitachi's special task force aims to create unmanned operations in five years, accompanied by a 70 percent reduction in assembly man-hours. This means they are seriously planning to put robots into assembly operations, which have been somewhat neglected by the

robotics manufacturers. Hitachi has deployed 500 engineers to work on nothing but this project".[36]

Nevertheless, this extent of innovation is not typical of all industries. In the car industry "the level of technology employed is still too low to substitute for the real skills of man. Most of the workplaces where microelectronics equipment has been used were already automated (and) the introduction of more extensive microelectronics technology would depend on changing production lines completely".[37]

A survey reports that the spread of microelectronics in Japan had been associated with a marked growth in employment of science and engineering majors coming from high schools and colleges, and also with growth in the number of machine operators doing simple or unskilled tasks.[38] A case study of automation in software development found that "companies hired better educated staff over time but adopted automated techniques aimed at simplifying work, allowing employees to 'supervise' automated processes". Another survey of electrical machinery industry workers reports that machine 'supervision' and monotonous routine work has increased. Despite this routinisation of tasks, the employers continue to seek qualities such as meticulousness and readiness to learn new things.[39]

As in other advanced industrial countries, it appears that Japan too is experiencing the contradictions inherent in high technology. Higher levels of qualification are required but the tasks themselves have become more simplified and general.

2.2b The introduction of new technologies: changes in company and work organisation and job content

Some of the observations made above also apply here, and especially noteworthy are the differences in degree of technological sophistication from one enterprise to another and even from one shop to another. For example, the introduction of numerically-controlled machine tools in machine shops in larger firms has caused changes in job content, principally a deskilling of the machine operator's job although the operator remains responsible for installation and maintenance and for machine operation. "However, after a certain number of NC (numerically-controlled) installations have been reached

it is more common to 'farm out' maintenance and installation functions to a specialised group of skilled workers".[40]

Skilled workers are also now obliged to become familiar with programming tasks and to operate a number of different types of machine tools. While the machine operator's job has become simplified, the job scope of skilled workers has been enlarged. "In a way, the outline suggests a return to the multi-skilled craftsman/operator prevalent in smaller specialised enterprises until recently but long gone in larger firms".[41] As for engineers, it has been found that they now need to know more about other kinds of engineering - electronics engineers more about mechanical engineering and vice-versa.

The government committee set up to study the impact of microelectronics found that more and more small enterprises have recently introduced microelectronic equipment. Of firms which subcontract to the machine industry, over half have introduced some kind of microelectronic equipment and two-thirds of those with less than twenty employees were planning to do so.[42] Thus the changes in work organisation and job content we referred to - more monotonous supervisory routines along with broadened responsibilities - show signs of becoming widespread.

The turn to robots as a valid way to keeping Japan internationally competitive apparently has the approval of both employers and workers. Employers emphasise the advantages of automation to replace occupations which are hazardous. It appears, however, that "most companies don't know how to make use of...robots yet, because interfacing them with humans is very difficult".[43]

Nevertheless, there is a shortage of workers in heavy duty skilled jobs and "younger workers are increasingly unwilling to man the jobs which tend to be boring and repetitive (while aspiring) to white collar jobs which involve greater task variety, intellectual challenge, and continuous learning. Both age and higher skills content add to wage costs which, in the absence of offsetting productivity gains, threatens the firm's competitive position". Automation is seen as something of a solution to this dilemma. In Japan, worker and technology are not viewed as being in conflict, such that new products or production processes are seen by workers as adding to their job security".[44]

3. Education and training policies to promote technological innovation and structural change

3.1 The government's role: the educational system and formal training

3.1a Schooling as preparation for the working world

Our first task is to discuss the ways in which the educational system prepares for or anticipates work in industry, after which we will turn to training sponsored by the government.

The predominant features of Japan's educational system are its size (which comes from the large numbers of students who continue to post-secondary schooling) and its competitiveness (because "access to the top universities greatly influences career ladders in government and the largest corporations".[45]

Concerning the first feature, the numbers of graduates from lower secondary schools are in fact declining consonant with the general aging of Japan's population, but now almost 95 percent of these graduates go on to upper secondary school (as opposed to less than 60 percent in 1960). As a result, upper secondary school graduates have swelled in number by almost 500,000 between 1960 and 1982; they now number 1,450,000. And 30 percent of them (as opposed to 17 percent in 1960) go on to post-secondary education.[46] The number of two year colleges, professional schools and universities has grown to over 1000, and the number of students enrolled in these schools exceeds two million.[47] About 11 percent of them - mainly women - go to junior college "after which most enter employment, usually in clerical positions".[48]

The total effect of this immense investment in higher education is that in 1978, 15 percent of all workers had higher education qualifications and by 1988 it is estimated that it will be 25 percent. "Expressed in sheer numbers, the educational reforms have moved Japan much closer to the United States than Europe in terms of universal access to higher learning".[49] Until a decade ago, over 40 percent of secondary school graduates entered the labour market. "Today this percentage has greatly fallen and has compressed the supply of labour for blue-collar jobs".[50]

At university, one out of five students majors in engineering, and in 1982 Japan produced 74,000 engineers, 18,000 engineers below first degree level, and a further 43,000 graduates in other science fields. However, the goal of education in Japan is not narrowly technical, and "the four years spent on an undergraduate course have more do to with time-serving to accrete social and process skills than on the acquisition of technical skills".[51]

The first two years of post-secondary education are spent on a common curriculum, as is schooling during secondary years, where technical and vocational education is rarely found. The most important goal of the educational system is to produce well socialised individuals who can contribute to industry. "As a post-industrial society, Japan now has a clearly multi-layer educational class which provides career ladders marked by entry points determined by education credentials".[52] The main criterion used in employment decisions besides level of educational attainment is attitude: "Employers are seeking the ability to learn and to work with others". There is a core curriculum of seven compulsory subjects which "focuses unwaveringly on 'the fundamentalá' (and) the overall aim is 'education of the whole person'".[53] Major employers are not interested in technical training or vocational education because they will do their own training of the new recruit. Their primary aim is to ensure that the recruit has the necessary attitudinal characteristics that will allow him or her to adapt to a changing work environment.

A study of the training and education systems of the Federal Republic of Germany, the United States and Japan concludes that in Japan "in the main, the system is simple and surprise-free to suppliers and users alike. The purpose of education is clear-cut. It provides what the dominant voices in industry and commerce want, in the national interest, and...it is regarded as socially, politically and economically efficient. It is not considered as an appropriate provider of anything looking like training...Most respondents firmly agree with the OECD's 1973 conclusions, that Japan's 'unspecialised and theoretical education provides employers with an intelligent, adaptable workforce". The skills imparted are "concentration, compliance, ability to work with others, motivation, self-reliance and capacity to adopt a leadership role. There is a high qualitative dimension to education output".[54] It is also an "intensely competitive merit-based system" which is heavily examination-oriented, and an effective preparation for the competition

characteristic of the industrial world which awaits the successful student.[55]

Japan's firms derive a distinct advantage from this kind of socialisation/education. "Better educated workers easily fit into the Japanese corporation where the relationship between the individual and job is not clearly defined as in the West. New recruits can easily be shifted from one task to the next on a regular basis...(which) increases the flexibility of work allocation when technology is changing, and serves to enhance individual socialisation into the firm's corporation philosophy".[56]

In a U.S. Department of Education study entitled "Japanese Education Today", which was released in 1987, the Japanese educational system was described as "a learning society of formidable dimensions" and the ties between schools and the job market were found to be "closer and more effective than in most other industrialised nations". The high average level of achievement was explained by well-defined curricula, close parental involvement in children's education, the high social and economic status conferred on classroom teachers, and the "hard work" which students devote to their education.

On the other hand, the study also remarked that colleges and universities in Japan are not "a world-class educational system" and have poor teaching and light academic demands. Moreover, it noted that many Japanese political and business leaders felt disturbed by the failure of primary and secondary schools to develop "creativity" in the students.

What kinds of jobs are obtained by graduates at different levels of the system? In general, lower secondary schooling leads predominantly to skilled work in manufacturing, while upper secondary school graduates may go either into manufacturing occupations or clerical work; almost 30 percent of them go into the service sector, including sales. Over half of all junior college graduates can be found in clerical occupations, and one third of them in professional and technical work. The same holds true for university graduates, except that slightly under one half of them are in professional and technical positions.

3.1b Training and the workforce

In Japan, most training is provided by the employer and the enterprise. First we will look at what the government provides.

As we have already pointed out, employers do not view the educational system as a training system which should prepare students for specific technical or professional jobs. Nevertheless the government does provide some vocational training, "half-heartedly, for those unable to compete academically".[57] This occurs at the upper secondary (post-compulsory) level, usually after the age of fifteen. At that level there may be either full time (three year), part-time or correspondence courses all leading to the diploma, and the courses may be either general of specialised depending on the school concerned. A general course does not train for a particular vocation and permits the student to advance to higher education if desired, while a vocational education course provides specialised training. Training of this kind can be found in about a quarter of all upper secondary schools. A student may, however, bypass upper secondary school entirely and go to a technical college for training in mechanical or electrical engineering, industrial chemistry, etc., though relatively few students do so. Students can also obtain vocational training in external courses and proprietary schools recognised by the Ministry of Education.

Since the government is not expected to provide employers with technically trained manpower, employers "are indifferent to VE course taken at the post-compulsory stage because they recruit people into membership of the organisation, rather than into occupations...and even in vocational courses provided in senior high schools specialised subjects occupy only thirty percent of the total syllabus and are not normally designed to impart immediately useable skills".[58]

Most of the government's activities are geared toward encouraging training at the industry level, where real training is expected to take place. It offers training support for small firms and also for the unemployed, the displaced and the disadvantaged. "The State's primary role is...to encourage others to train, in their own and the national interest".[59]

The government does, however, maintain a few training centres of its own and many more through other agencies. It also provides instructors for industry training through its Institute of Vocational Training, and maintains a research centre for vocational training. It does skill testing and awards certificates, now held by one million workers.

Vocational education in the secondary schools is under the jurisdiction of the Ministry of Education, and manpower forecasting is the task of MITI and other bodies. There are some criticisms of the separation of vocational training within and outside the school system "with insufficient overlap to form a VET network properly understood".[60] However, also stressed are both the broad public dissemination of information and the encouragement of academic research projects about the whole VET system.

Public sector vocational training - most of which is in fact delivered by prefectoral governments - is not a high priority, and the number of training institutes has been declining in recent years. "Expressed in terms of GNP, Japan's vocational training effort (not much more than 0.1 percent) is negligible".[61] Yet the number of public sector trainees has more than doubled since 1970, many either in Occupational Capacity Redevelopment Training or in upgrading. "The state does play a more prominent part in retraining and in upgrading training for adults (though here again it is marginal to the private sector effort)".[62] At school level, expenditure is somewhat greater, whether the training is delivered within the public school system or by subsidised proprietary providers.

3.2 Industry's role: the enterprise in education and training

Private sector training is three times as frequent as that provided by the public sector, although it is difficult to obtain precise figures. There are three main kinds of industry training: off-the-job training in technical skills, on-the-job training, and self-development.

There is "a massive and unchanging base commitment to off-the-job training in technical skills",[63] "high levels of on-the-job training for workers, and in-house executive training for managers".[64] There are training modes which "even some employers might not define...as training (as opposed to human resource development)..(but which) activities have been

consistently argued by comparative studies to have contributed significantly to Japan's superior record of adjustment to recession".[65]

Off-the-job technical training generally takes place in enterprise-managed schools, most operated at the junior college level. These schools provide both training for new entrants and continuing education/retraining for the existing workforce. "Initial training is overwhelmingly provided by employers, with the State's effort declining".[66]

In practice, the largest firms are most able to offer special training courses, whereas smaller firms often lack the resources to do so. However, smaller firms are gradually increasing their training. There are large numbers of workers involved in upgrading courses. Most growth in training in Japan "has come about through increased private sector activity, which the government regards as the most flexible response mechanism".[67] It also appears to be true that private sector spending on training increases during recessionary periods, although it is not clear whether this is because some of a firm's workforce can then find time for retraining or whether this training is specifically offered as an adjustment mechanism. The industry's training expenditure grew by over thirty-five percent between 1979 and 1982 alone, and the number of upgrading trainees increased from 40,000 to 123,000.[68] Some firms receive government subsidies or other kinds of training assistance from the government when the courses have been "authorised" and ascertained to meet prescribed standards. These company training programmes also train management personnel, as there are no American-style professional management schools.

We will discuss below the special provisions for training workers in declining industries who are suffering displacement. Here, we take up the matter of training workers for high-technology jobs, i.e., for operating numerically controlled machine tools and robots. Workers do not become familiar with automated processes in either secondary school or post-secondary institutions because few high-tech course offerings exist; in fact "some universities do not consider robotics an appropriate topic for inclusion in engineering curricula. As a result, engineering graduates often require additional instruction before they are prepared to work in automated manufacturing facilities".[69] Some private schools offer robotics programmes, but most of this training is offered directly by manufacturers, and over 60 percent of the companies using high-tech equipment have instituted

their own training programmes. They suffer from a shortage of instructors and a general difficulty in setting up the courses, especially in the smaller enterprises. Sometimes a "two-phase" instructional method is followed: One worker is trained outside - perhaps by the equipment manufacturer - and becomes known as a "core-worker". He then provides on-the-job training for the other workers in the unit.[70]

Enterprise-based training for "entry-level and young workers is more extensive and formal than instruction for older employees, although experienced workers automatically receive formal training upon promotion. The amount and type of training and retraining received by an individual is highly dependent on the stage of the worker's career and, to a lesser extent, on expected tenure".[71] In cases of restructuring or automation, a worker may be shifted to another part of the same firm, or another firm in the same industry. Where flexible manufacturing systems have been introduced, over half of the firms transferred personnel to other jobs, while eighty percent provided the workers concerned with the education and training needed to meet the changes in work content.

Once a worker has been trained, the most usual way in which he will receive additional training is on the job, which is closely linked to self-development. "The importance of OJT, i.e., on-the-job training, as a contribution to business performance is the most obvious characteristic of Japanese training methods, although it is impossible to quantify the proportions. (This training is) firmly linked into an individual's career progression, (making) the commitment of individuals to self-development much greater". Moreover, such training is carried out according to "a variety of in-company arrangements which are quasi-formalised".[72] The desire to develop one's capacities and acquire skills because it is in one's own interests to do so is "the foundation of, and the motivating force behind OJT". It can take many forms - including group work, job rotation and transfer, and multi-skilled work targeting. The key individual in this kind of training is the foreman, who is expected to teach as well as to supervise.

Self-development "represents a massive development of human resources. Intra-enterprise education is dominant...a source of strength. It is continuous...The forms taken by OJT develop organisational skills in great depth and conceptual skills in some degree. Superimposed as they are upon technical skills which are not less than those of other nations, they explain

much of Japan's advantage in production. These forms of training have implications for flexibility. It was noted earlier that Japan had adjusted more quickly to recession".[73] The emphasis on self-development is such that workers are often required to keep diaries of their training, as do their employers, "and these form the basis of individual career planning".[74]

3.3 Retraining older workers

Older workers in need of retraining include both those who have been shifted from one industrial plant or unit to another and those who have been displaced.

"The State does play a more prominent role in retraining and upgrading training for adults (though here again it is marginal to the private sector effort)".[75] It may provide some financial and other help to workers who have been dismissed, but this is not usual. More commonly the government works through its Employment Stabilisation Fund (established in 1977) to provide assistance to employers for employment adjustment (manpower reduction) and for training and business conversions.

"In addition, under different administrative arrangements, subsidies were made available to encourage employers to hire and hold more middle-aged and older workers".[76] The State would pay for their training and education for a six month period. Employers in structurally depressed industries have also been required to prepare plans for assisting employees in retraining and job-seeking in other industries. In some circumstances the government will itself finance job retraining schools; in the depressed city of Muroran, for example, the government school grants licenses in trades ranging from industrial painting to bridge construction.

It is likely that under pressure of industrial readjustment, the question of retraining will become much more urgent in the near future. Manufacturing lost 260,000 jobs in one year (November 1985 - November 1986); many jobs have been exported. Workers must now learn skills needed in technologically advanced jobs in the service sector.[77]

For workers fortunate enough to have "lifetime employment", the retraining problem consists of acquiring the skills which make it possible for them to work elsewhere in the enterprise or a related enterprise as production priorities change. Japanese employers have assumed the obligation of providing continuous retraining for such employees, and this problem is therefore not a "public" one. However, the number of workers having such employment security is expected to decrease in the future.

3.4 Attitudes toward change and motivation

The receptivity of all concerned to the need for structural adjustment and industrial change and innovation appears overwhelmingly positive. Dore mentions Japan's "strong sense of national purpose" which makes businessmen co-operate with the government to reshape the industrial landscape and which also creates a consensus "among trade unionists and production workers as well as among managers and bureaucrats - a general conception of the inevitability and even desirability of continuous structural adjustment, of positive adjustment as a positive good". He points out that this "extraordinary...adjustment would have been impossible if workers, either individually or collectively, had resisted change. In the Japanese context...it is wrong to place workers and unions in a secondary position...A truer picture would be that workers and unions actually saw the need for adjustment roughly in the same way as government and management did.[78]

The adjustment process is very demanding on workers, but "the popular assumpton shared by managements and unions alike is that Japanese workers have an infinite supply of personal resourcefulness and adaptability...Individual workers must sacrifice a large amount of their own time to acquire new knowledge and skills. Under the circumstances, the failure to move along with on-going change is a personal shame".[79]

Certain institutional factors reinforce this attitude, chief among them probably being "lifetime employment" and also the practices associated with self-development. Lifetime employment (usually until the age of 55) generates loyalty and the willingness to make a personal commitment to any education or retraining activity sponsored by the employing enterprise. Self-development encourages the worker to engage in various personal development activities, sometimes with some coaching and often by attending corporate-sponsored activities or courses, frequently during his free time. All accounts indicate

that this self-development is very successful, and this is undoubtedly because the employee identifies with the problems and imperatives of the enterprise and the ways that have been chosen to deal with them.

4. Assessing the effectiveness of Japanese training and education

4.1 How well do current policies and programmes support industrial restructuring?

In Japan, the closeness of fit between education and training and current industrial requirements seems to exceed that in other industrialised countries which are undergoing readjustment. There are, however, early indications of problems which may grow in the not too distant future and weaken this exceptional relationship between education and training on one hand and the world of work on the other.

In the future, the education and training systems will be called upon to come to terms with certain labour market and demographic changes more than they are today. One potentially serious problem is the aging of the workforce. Even without increased industrial readjustment, the retraining and upgrading of older male workers will loom larger as a set of activities in need of strengthening. The dislocations caused by readjustment and technological retooling can only add to this.

Now, industries do the bulk of training for older workers, whether they are shifted from one unit to another or whether they require high-tech training. The demand for increased employer training activities will grow, and it might be predicted that demands for government action will also grow, in at least three ways: Demand for more financial support for private initiatives; direct government-run retraining; and increased training of instructors for work in both public and private retraining. Much of the retraining will concern automated processes, where there is now general weakness, and it may be given off-the-job or outside the enterprise.

Another form of training which seems not to exist much in Japan today is that for services, sales, and office work rather than for industry itself. Part 1 highlighted the dimensions of the shift to a service economy; there appears to be no concomitant increase in training for this "new" employment,

either by government or by the enterprises concerned. Involved in this training, hopefully, will be more women. The education and training system presently makes little or no effort to reach women in order to strengthen their capabilities and improve their "reputation" as able workers to whom employers should grant increased status. It is not clear how long women will continue to accept the secondary role of "employment cushion" which they currently have. They should therefore be encouraged to train for automated industry, automated office work, etc.

We will now comment on some factors of the education and training systems and the job market. The question arises about whether the education and training systems are "systems" at all. Also in doubt is whether the government's input into the vocational training system is sufficient: "Many impartial observers complain that the public sector is not doing enough, and that there are dangers in leaving flexible response to the private sector...(But) there is little by way of concerted complaint, and regular skill shortage surveys do not suggest serious problems".[80] However, vocational education within the schools - i.e., within the upper secondary curriculum is actually becoming weaker. "The emerging problems of vocational high schools can be seen in several cases in which students and teachers alike are clearly demoralised...Syllabus changes appear on balance to have reduced the (never particularly strong) vocational course content".[81]

Two other potential problem areas are the tendency - found in many countries - to hire on the basis of educational credentials without regard for the technical knowledge or capability of the job candidate. This tendency reinforces the rush toward advanced degrees and discourages the pursuit of skill learning. And in industry, there are blue collar jobs that few apply for since young people today have higher career aspirations and want to obtain diplomas beyond the (lower) secondary school level.

Another problem area may be the kind of knowledge required in the process of factory automation. Knowledge requirements are becoming broader while job tasks become more supervisory and, in some cases, more boring. Higher knowledge qualifications do not always fit with actual job content and this may give rise to discontent. This emerging reality is of course not confined to Japan, and it is an area which may require more innovative solutions than are currently being considered.

4.2 Policies which can anticipate and prepare for change

The Ministry of Labour Basic Vocational Training Plan discusses the key tasks facing vocational training in Japan. Some of these tasks may resolve, or partly resolve, some of the problems mentioned above. Here are five major tasks for the vocational training system, as identified by the Japanese authorities concerned:

- Young people should be assured access to initial training (necessitating improved career guidance in schools, more formal training by private firms, more relevant public provision, etc.);

- Existing employees' education and training should be strengthened (e.g., by employers' schemes, and by linking public training more to employers' needs);

- There should be more effective retraining of the displaced/disadvantaged, and it should be geared more closely to emerging job opportunites e.g. in service sectors;

- Progress should be made towards a national ability assessment scheme. More emphasis should be placed on occupational ability, and on linking private and public sector skill assessment systems to create an atmosphere of respect for skills; and finally

- There should be promotion of international co-operation in vocational training (to keep Japan "in harmony" with the global system).[82]

The national ability assessment scheme would be "a new element in vocational training planning, designed to promote a 'learning atmosphere'". Currently, "private sector assessment is flexible in than it is to standards judged to be appropriate to the company concerned rather than to some fixed, national model".[83]

There is, then, a call for more uniformity in skill teaching and skill assessment. The underlying rationale for this can be assumed to be the expected greater mobility of the labour force in the future as the process of

structural adjustment in industry intensifies and involves more frequent shifts of workers between industries and across sectors in the economy as a whole.

4.3 Interaction among policymakers

The implementation of training in Japan (not the education system or school-based vocational training) requires close co-operation between the government and the enterprises which do the bulk of the actual training. This is all the more true of enterprise training that the government supervises. This must be an on-going form of co-operation, although we do not know precisely what mechanisms are involved in deciding the content of the training courses or even the broader policy lines followed in authorising and financing the courses. We do know that "reverse" collaboration - in other words, enterprises' input into education and vocational training outside the enterprise setting, for example in the school system - is virtually non-existant.

It is therefore difficult to ascertain what on-going collaboration there may be, and what real weight the government has in shaping enterprise training activity. The government does provide instructors for public and private technical courses, and may determine in practice a large part of the content of such courses. The prevailing view up to now, however, seems to be that industries and enterprises are the best judges of their training and skill requirements. The trade unions have apparently had no input into these matters.

5. Conclusions and recommendations for further research

In Part 4 we discussed some of the basic problem areas which Japan's education and training system will have to face in the future. What is of particular interest in this concluding section is the Japanese attitude toward their own system and how well it fits present and anticipated economic requirements. A critique and re-evaluation of the current vocational training system seems to be well advanced in Japan, and a shift of emphasis has been advocated to overcome some of its shortcomings. This rethinking has occurred among training policymakers who are apparently making efforts to identify future problems before they become unmanageable.

What we would recommend in terms of additional research is more understanding of these problem areas and of the tasks advocated to deal with them, including actual operative changes. We do not expect to find extensive modifications in a system which seems, on balance, well adapted to current labour market conditions. On the other hand, the willingness to engage in self-scrutiny and fine-tuning seems to outpace that found in some other advanced industrial economies. In particular, what bears watching in Japan is the emphasis now being advocated for skills and occupational ability assessment. If this occurs it will bring Japan's training system (and possibly education) system more in line with those of other industrially advanced countries. Will there, one wonders, be a concomitant decrease in the emphasis on self-development, which now requires so much employee initiative (and also unpaid time input). Self-development is one reason often given for the outstanding flexibility of Japanese workers in adapting to structural change. It will be interesting to see what effect an increase in formal training will have upon it.

It is especially important to watch for changes in Japan's education and training systems because they have up til now been highly successful in anticipating change in industry and developing workers' flexibility. It may be that educational and training innovation will prove useful for other countries. "The five problem areas calling for particular attention...show that neither the problems, nor the proposed solutions, are uniquely Japanese".[84] We may nonetheless be able to identify some original and useful innovation in the implementation of the proposed solutions.

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Education and Training Policies and Programmes to Support Industrial Restructuring in Singapore

Introduction

Singapore is much smaller than South Korea and Japan. A small population and territory make it much easier to formulate plans and implement policies in the areas of education and training. This feature is further aided by Singapore's highly centralised government, which since 1960 has placed overriding importance on national development.

Before proceeding, a brief word is necessary about our sources. The discussion of the industrial restructuring process and its implications for skill and education relies on four sources, including two ILO publications. They are in substantial agreement as to events and, usually, interpretation as well. However, the subsequent discussion of educational and training initiatives relies very heavily on publications of the Singaporean Government's Vocational and Industrial Training Board, a fact which may constitute something of a shortcoming. In particular, it is not always possible to accurately assess the degree of distance between government plans and their realisation; between the way the government would like the vocational training system to develop and the way it is in fact developing. If anything, our primary recommendation would be for further research investigating how events are actually occuring.

Singapore differs from South Korea and Japan not only in its size. Unlike these two countries it has a negligible agricultural sector, since it is an island city-state. Although its population is small, it is ethnically and linguistically heterogeneous, and its population density is very high. It has a tradition and history of entrepot trade and considerable commercial and financial experience, as well as significant foreign investment. Its employment rate is very high and its economic situation is excellent, providing a strong base upon which to carry out restructuring. This restructuring has been carried out without the aid of any formal development plans except during the years 1961-64.

1. Industrial restructuring: causes and strategies

1.1 The industrial restructuring effort

Before 1979 and its "second industrial revolution", Singapore's industrial sector was low-wage, low-skill, labour-intensive and export-oriented. It relied on conventional technology, and much industrial activity consisted of the transformation of local or easily obtained raw materials for export to nearby markets. Leading sectors were food, beverages, printing, chemicals, transportation equipment, and petroleum refining and products.

But in some of these sectors value-added was declining, while in others - particularly electrical and electronic machinery, petroleum refining and products, and transportation equipment - it had begun to rise. The latter were the leading sectors in Singapore's industrial progress between 1960 and 1979, and during these years manufacturing's share of GNP rose from twelve to twenty-nine percent, with well over half of output being exported.[1]

Many of these export-oriented companies were foreign owned, as Singapore had begun to actively encourage direct foreign investment in 1959, when the Peoples' Action Party became the only governing party. By 1979, when the government encouraged more high-technology industries, three quarters of all export-oriented capital expenditure and fifty-eight percent of manufacturing workers' jobs depended on foreign investment. "Whereas wholly and majority foreign-owned enterprises accounted for only about a quarter of all manufacturing enterprises in 1980, they produced three quarters of the output".[2]

Major investors came mainly from the U.S., Japan and the Netherlands, and they derived a number of advantages in Singapore: a well developed infrastructure; a good location; a stable government which instituted strong wage guidelines and pursued responsible fiscal and monetary policies; and certainly not least of all a labour force which was well educated and adaptable. New industries were offered generous tax and other incentives to settle in Singapore.

By 1980 there was "a trend towards producing more skill- and capital-intensive products, with higher domestic value-added, mainly from skilled labour inputs and higher wages", and output per worker in the more labour-intensive manufacturing industries was also growing slowly over time.[3] Firm size tended to stabilize or even decrease, and partly this resulted from a labour shortage. Foreign workers came in from other Asian countries; many were low-wage women workers who received temporary residence permits to work in the textile and electronics industries. One aim of the government in encouraging restructuring has been to diminish the need for imported labour, while continuing to encourage permanent residence for "professional, technical and industrial skills and talents from overseas".[4] The strategy for achieving this, it is thought, is by encouraging the development of skill- and capital-intensive industries.

The major reasons for restructuring, then, included the domestic shortage of workers - a situation peculiar to Singapore - and also the increased international competition in foreign markets. Singapore in particular faced losing its preferential tariff position under the GSP (Generalised System of Preferences) for exports to the markets of the EC, the USA and Japan, as there was already by 1979 "much pressure from the international community to classify Singapore as a developed nation", a reclassification which would make Singapore's low-technology exports uncompetitive in the developed countries.[5] Additional factors encouraging restructuring were declining productivity growth in nine industries in the late 1970s, and the feeling that "the extension into 1980s of a strategy of industrial development which does not encourage rapid productivity gains will not provide the population with the wages and a standard of living that are commensurate with rising expectations...Singapore has to update its economy to produce goods and services that require more skills and technology and less labour".[6] Throughout the 1970s, wages were held artificially low and not allowed to rise to market levels, but this restrictive policy could not be continued indefinitely, especially since the residents of Singapore had grown accustomed to probably the highest standards of living in South East Asia.

Unlike other countries studied for this report, restructuring in Singapore took place not in the midst of economic crisis but to ward off expected problems. Real average annual growth throughout the 1970s had been 9.4 percent "despite a slowdown in the world economy, the four-fold oil price

increase in 1973, world recession in 1974 and 1975, and protectionist restrictions in the leading industrialised countries against Singapore's manufactured exports".[7] The leading export markets were Japan and the U.S.

Restructuring had the aim of encouraging investment in higher technology and higher value-added industries, of promoting industrial research and development, and precipitating industrial change either through the phasing out or upgrading of an industry so that "the scarce input, labour, should be used more efficiently".[8] In the garment industry, for example, labour-intensive operations were shifted to neighbouring countries while larger firms were moving upmarket to produce higher quality and more fashionable clothes, automating many of their operations to save labour and introducing more sophisticated machinery than their chief competitor, Hong Kong. In the textile industry "the government hopes that long-run upgrading will lead to specialisation in the production of textile machinery rather than end-products for export".[9] Electronics, "a higher-value industry with rapidly growing world markets...is poised to make a significant technological and product shift in an upmarket direction".[10] Other priority industries were the chemical process, metal engineering and machinery, heavy engineering, and the electrical and electronic industries.

1.2 The government's role in restructuring

In Singapore the government has been an economic actor throughout the development period, and as in South Korea and Japan, it would be hard to exaggerate its influence on the restructuring process. "Despite the relative lack of controls, and the dominance of market forces in allocating resources, Singapore's domestic economy is far from a laissez-faire one". In addition to encouraging private investment in various ways, "government statutory boards and state enterprises and joint ventures provide all social and economic infrastructural facilities, and the basic needs of the majority of the population. They also engage directly in productive activities, often in competition with the private sector".[11]

The government selected three main policies for inducing Singapore's enterprises to restructure. First, wage controls were lifted. The National

Wages Council strongly recommended wage increases of 10 - 20 percent per year between 1979 and 1981 as a way of encouraging employers to hire fewer workers and upgrade their productive processes and mangerial techniques. After 1982, annual wage increases were brought into line with productivity growth.

The second policy was to expand existing industrial incentive schemes - tax deduction, capital allowances, etc., for certain priority industries. Deductions were given for R & D expenditure to encourage wider use of new technology, and the Economic Development Board aided potential investors in making production and technology choices. Over 300 industrial companies have been carrying out some R & D activities in a wide range of fields, sometimes with the collaboration of the national government and/or the National University of Singapore. These companies are all branches of multinational corporations and no local company appears to have an R & D budget. "Investment incentives are now selectively awarded to deserving firms and projects on a case-by-case basis favouring capital- and skill-intensive, technologically sophisticated industrial projects and designated priority industries".[12] However, Singapore's R & D expenditure in 1982 - 0.31 percent of GNP - "is a tiny amount compared with the advanced industrialised countries...and even when compared with some other newly-industrialised countries".[13]

The third policy has been to strengthen formal education and training and enterprise-based training, a subject which will be discussed in Part 3.

It is difficult to assess the effects of all these policies. The wage policy brought Singapore's wages in line with those in Hong Kong and Korea. According to the National Wages Council there had been substantial yearly growth in real productivity. This growth was 2.6 percent in 1979 and 5.4 percent in 1981. However, in the early 1980s textiles and electronics, which together employed fully 40 percent of all manufacturing workers in Singapore, were still very labour-intensive and low technology by the standards of advanced industrial processes, although "by 1984 Singapore could boast 564 industrial computer-controlled NC and CNC machine tools, 86 industrial robots, and 220 CAD/CAM stations, with the numbers increasing rapidly".[14]

Judging by the standard of living achieved, there is little doubt about Singapore's success. "The hard face of capitalism has been softened by government measures to ensure that most people have the basic necessities of life - food, housing, jobs, and educational opportunities".[15] Yet, the much-publicised "second industrial revolution" of 1979 was not new so much as a renewal and intensification of the investment incentives, skill training and technological upgrading policies put in place in the early 1970s, all of which had been de-emphasised during the 1973 recession and its aftermath.

It is unclear how much policy formulation is the work solely of the government or whether there is other input. "Although development strategy is decided by the government, the business community is frequently invited to provide feedback and comments...on an ad hoc basis. It also has representatives sitting on the boards of many policy-making government agencies...In addition many local and foreign businessmen have personal links with top members of the government...and are informally consulted on policy issues...(Implementation takes place) on limited consultation with workers', employers' and other citizens' groups...(and) the state is the major actor in the industrial environment surrounding the Singapore economy".[16]

The picture is not, then, one of real collaboration between the government and other economic actors but instead one of occasional consultation with non-governmental forces. As for the population itself, most people are of immigrant origin and this in itself often tends to be associated with an open, forward-looking behaviour oriented toward rapid change and self-enhancement.

2. Industrial restructuring and the workforce

2.1 What workers do, what workers know

2.1a What workers do: changes in the distribution of labour

Singapore is too small for a real agricultural sector, and the working population is distributed over trade, industry and the service sector, including finance, transport and communications. The total population of almost 2.5 million is young, and expanding at the rate of 1.2 percent per year. The labour force is growing rapidly; it more than doubled between 1960

and 1980, reaching 1.09 million, of whom about eleven percent were foreigners. Unemployment is low - around 3 or 3.5 percent in recent years.[17] Foreigners are divided into residents and non-residents. The former are permitted to bring their families, whereas the latter are not. Usually only skilled or professionallly educated workers are given permanent resident status.

Changes over the last twenty years have seen an increase in manufacturing employment from slightly over 14 to 30 percent of the workforce, and also an increase in financial and business services employment. There have been smaller job increases in construction, due to the government's extensive building and land programme and in transport and communications. All the other sectors - agriculture, trade, and most notably "other services" - have declined. Outside industry, non-residents are most heavily concentrated in construction. Residents are mostly in trade. Sixty five percent of the labour force - whether resident or non-resident - is male. Most of the non-residents are of Chinese origin and under age thirty, single, and with only primary schooling.

2.1b What workers do: changes in occupations

An important aspect of Singapore's development is the growth of the electrical industries and electronics. Manufacturing employment as a whole grew by 12.4 percent a year between 1960 and 1980, and the principal employers were electronics and electrical industries, followed by textiles, garments, and transport and oil rig equipment.[18] The electronics and electrical industries sector grew from a workforce of 13,850 in 1957 to 178,404 in 1980 - by which time it made up fifty five percent of the industrial workforce. Lagging far behind were textiles (48,193) and chemical, petroleum, rubber and plastic products (24,840).[19]

Over four fifths of the employees in the electrical and electronics industries were women in 1980. "Employment creation in the electronics industry...has contributed more to the rapid increase in the female labour force partipation rate...while average remuneration in the industry has remained about twenty percent below the average for the manufacturing sector as a whole. Male and skilled workers comprise only a small proportion of workers in electronics...(and) the most common occupation for a woman in

Singapore is that of electrical or electronic equipment or component assembler".[20] About ten percent of these women are foreigners, as are over a quarter of the women in textiles and garments.

Although working women represented forty percent of the labour force by 1980, they were "over-represented relative to men in lower-level industries and occupations, and underrepresented at the higher levels", earning on average 64 percent of male wages in a manufacturing sector already known for its unusually low wages.[21]

The major manufacturing sectors in Singapore are generally characterised by a low level of technological development and they have relatively low skill and knowledge requirements. The labour force, meanwhile, has higher levels of schooling like in South Korea and Japan; in 1980, over 90 percent of men and 75 percent of women had completed some form of secondary education. But the technological sophistication appears to be less than in other countries. There are therefore few skilled positions. And in non-production-related activities, clerical and sales positions proliferate.

In fact, less than ten percent of workers were in professional or technical work in 1980 and only half that number in administrative and managerial posts. Foreign labour is present particularly at the lower and upper reaches of the skill and knowledge continuum. The Singapore government hopes to attract highly qualified foreign workers from other Asian countries to aid in the restructuring process, while substituting foreign unskilled workers at the lower levels by automated processes.

Every year more education and training brings an upgrading of the occupational structure. The proportion of professional, technical, administrative and managerial workers is steadily increasing and reached almost fifteen percent of total employment in 1982. Clerical workers increased and sales and service workers declined, and altogether these jobs stabilised by 1982 at forty percent of the workforce. Very gradually declining are production and related workers, representing 38.5 percent of employment in 1982. This is not only due to lower manufacturing output but also to increased mechanisation and automation.[22]

According to Lim and Fong, "the labour market has functioned well in terms of reallocating labour between economic sectors and occupations in response to changing supply and demand...Labour has shifted from primary and tertiary sectors of the economy towards manufacturing, and from sales, service and agricultural occupations towards professional and technical, managerial and administrative, and clerical occupations, as the economy has modernised...The labour market...has been particularly effective in increasing female labour force participation and the employment of foreign labour...(There has also been) a narrowing of the gap between the highest-earning and lowest-earning occupations in terms of pay" and a rise in workers' real income - but a decline in their share of national income.[23]

2.1c What workers know: changes in the knowledge, skill and qualification profiles of workers

Between 1960 and 1980, the literacy rate rose twenty percent, to reach eighty percent. There was a remarkable expansion of primary and, even more, of secondary education.

Secondary schooling is a four-year course with technical, academic or commercial specialisation in the last two years, at the end of which are O-level examinations or, for some, enrollment in a vocational institute. Students who do well in their O-levels take two-year junior college courses in arts, sciences, commerce, or technical subjects, followed by A-level examinations as in the British system.

Today, two-fifths of the workforce have a secondary education, compared to one fifth only two decades ago. Roughly 15 percent of the new labour force entrants were expected to be also university graduates by 1985 - a figure which represents "a doubling of graduate output, mainly in the science and engineering disciplines, since 1980".[24] Another 65 percent of the new workers were expected to be technicians and skilled workers.

Lim and Pang give an unencouraging picture of largely low-skill industries where workers' abilities are possibly underused, but also of poor quality schooling. "The rush to provide mass education at a level suitable for low-skilled employment in labour-intensive factories has led to a relative neglect of quality in the school system, resulting in a low level of

general educational attainment which current educational reforms are seeking to remedy".[25]

There are some differences in the ways various industries use skill and knowledge capabilities. Textile and garment workers "have lower skill and educational levels than electronics workers, perform more manual operations, and have less capital equipment to work with, (whereas) electronics is a technologically dynamic, rapidly growing world industry...The multinationals which dominate the Singapore electronics industry are highly competitive, and quickly responsive to international market forces and to product and technology changes in the industry"[26]. This description presents some problems; for one, it contrasts with the low skill and knowledge requirements of Singapore's industry described earlier. What the situation really is probably varies from one firm to another, and the contradictions will become even more apparent in what follows below. It seems that at least some industries are using state-of-the-art technology, even if it is only a recent introduction.

2.2 The skill and knowledge implications of industrial restructuring

2.2a The introduction of new technologies: skill and knowledge implications

Where new technologies are being introduced in Singapore, it is safe to assume that they are the same as elsewhere in the advanced industrial societies. This must be the case because Singapore needs to remain internationally competitive, especially since so much of its production is export-oriented. In textiles, there has been "substantial investment in new equipment such as computerised jet dyeing machines, fully automated cuff and collar systems, and computerised graders and markers. The skills of the workers are being improved through courses in production, machine maintenance, quality control and production management conducted at the Singapore Textile and Garment Training Center...The improvement in technology and skills has enabled the industry to produce better quality and more fashionable products.[27]

"In the electronics sector new projects have been set up in integrated circuit design and wafer fabrication, in the manufacture of computer memory storage devices...and in software development and programming for computerised

automated testing equipment. These are activities which will raise the capital, skill and technological requirements of the industry. As far as the production of consumer electronic goods is concerned, cost rationalisation programmes are being carried out, through further automation and the production of new micro-processor-based, higher value-added products...As a result of the automation and mechanisation processes introduced to increase productivity and reduce labour requirements, about seventy companies have been established to supply automation equipment and industrial robots...This sector is expected to grow between thirty and forty percent per annum over the next 5 years".[28]

The implications for education and training of all this upgrading of industry are fairly straightforward. Workers who remain in manufacturing must upgrade their skills. Their skills must also become more general to accomodate rapid shifts in production priorities and to adapt to new and automated production techniques. The degree and nature of this upgrading depends to a large extent on how sophisticated the automated equipment is. "Managers will have to give workers broader training if they wish to gain benefits from automation in its most extreme forms...(as) success in exploitation of new technology for profit often entails increasing the skills deployed by some sections of the workforce".[29]

2.2b The introduction of new technologies: changes in company and work organisation and job content

We can make here some reasonable assumptions, namely that both work organisation and job content are destined to change dramatically as automation advances, and also that the nature of the changes will not differ markedly from that already described for South Korea and Japan. Moreover, changes may take place even more rapidly in Singapore given its labour shortage, which sets it apart from the other two countries. The government policy of encouraging labour saving technologies to reduce reliance on foreign workers is an additional factor in pressuring for rapid change. However, these are mainly predictions which do not derive directly from extrapolations of Singapore's present technology endowment, since it is not notably in advance of those of the other countries mentioned. Nor does Singapore have an unusually intensive investment in R & D. On the contrary, both Japan and South Korea invest more in R & D.

3. Education and training policies to promote technological innovation and structural change

3.1 The government's role: the educational system and formal training

In 1968 a Technical Education Department was established and substantial reforms were introduced into the secondary school curriculum. It was revised to include more science and technology-related subjects and to de-emphasise purely academic education. In the university, accounting, business administration and engineering were given more emphasis. At the same time, the polytechnical schools and technical colleges began to expand and to train more technicians.

In 1979, with the growing emphasis on the skill and high technology component of the economy, government policy made post-secondary technical and professional training for industry a chief priority. This was simply an increase in emphasis, for in the late 1960s and early 1970s the government had also introduced various training schemes, including on-the-job training and joint government-industry training centres to provide the technical skills needed by industry. The Economic Development Board (EDB), which had been set up in 1961, gave help to industrial enterprises for the establishment of technical and managerial training facilities, and ran training schemes jointly with industry. More recently, the EDB has collaborated with industry in setting up three specialised training centres where trainees are registered as apprentices, and one more centre in high technology electronics sponsored jointly with the Japanese government. In the 1960s and 1970s, the bulk of industry-related training was on-the-job training and did not take place in institutes or training establishments.

As a percentage of total government expenditure, the Singapore government's expenditure on education for the year 1982/83 alone (the latest for which we have figures) was the same as for the whole period 1969/70 to 1978/79 - slightly over eleven percent (and growing). The focus of this expenditure has shifted, however, from primary education and technical/vocational education, on the one hand, to secondary education and advanced universities and institutes. Primary and secondary education now take up one third each of the total government education budget, and "tertiary" education takes up nearly one quarter. Technical/vocational

education has sunk to 5 percent, while adult education draws no money at all. An important category, educational development, was increasing its allocation.[30]

Despite the slight importance of vocational and continuing education in the government budget, some courses are nonetheless taught. They are almost exclusively administered by the VITB or Vocational and Industrial Training Board, founded in 1973, which "encompasses all vocations and skills upon which Singapore's economy and social development depends; the emphasis is placed on skills training for the industrial, commercial and service sectors".[31]

VITB is also responsible for all forms of skills certification. "Enterprises are encouraged to undertake their own training but recognition for such skills as may be achieved requires VITB inspection and approval of the curricula and the facilities."[32] VITB maintains its own training institutes, and plans on "a projected annual requirement for 11,800 (additional) skilled workers for the 1980s".[33] In 1982, the enrolment of all VITB institutes was 10,690, and in some years there have actually been declines in enrolment (e.g. 1981).

The actual components of vocational training programmes are one or two years of full-time institutional training for school-leavers. This training leads to the National Trade Certificate (NTCs) Grade 3, followed by on-the-job training "to complete the skill development of the basic-trained vocational institute graduate and the direct entrants through apprenticeship and other traineeship schemes leading to Grades 2 (intermediate level) and 1 (higher level) of the NTC".[34] The second major component is the Industrial Technician Certificate (ITC) programme, which is a trade or craft-based programme "with the addition of technician-level theoretical and laboratory training coupled with supervisory skill development".[35]

Presiding over the VITB is the Council for Professional and Technical Education, which makes recommendations based on the indicative projections of manpower requirements prepared each year by the Ministry of Trade and Industry. These projections are made by the Committee for Planning Technical Education, which is tripartite and also has representatives from the university and professional associations.

Also part of the Ministry of Trade and Industry is the Economic Development Board referred to above. Its activities include advanced technical training in special institutes of technology, joint training centres, and the Skills Development Fund. The latter was a government programme set up to enable employers pay part of training costs for their employees, but since firms did not use it, it has been stopped for the time being. The EDB also finances overseas training for Singapore students, a programme which in recent years has been a notable source of highly qualified manpower.

Advanced technical training takes place in a new computer institute, the polytechnic and technical colleges, and the joint industry training centres. Two other training institutes, run with German and French collaboration, were also recently set up. Intake in all these institutes, and the vocational schools, is not limited to Singapore citizens, and this is important because population growth and the number of school leavers are insufficient to provide the skilled labour upon which Singapore's development depends.

Unlike South Korea, Singapore does not emphasize vocational education in high school and also does not appear to place great emphasis on skill certification through examination. Nor did any source mention anything akin to the Korean emphasis in hiring practices on formal schooling to the detriment of technical education or on-the-job capabilities.

3.2 Industry and the trade unions in education and training

Industry appears not to have any autonomous training programmes or policies in Singapore, even though firms offer courses of various kinds. In a selected sample of companies in 1983, 2946 apprentices had completed two years of in-centre training.[36]

Enterprise collaboration is always collaboration with the government only, and there are specialised joint government-industry training institutes with a strong emphasis on practical application. The trade unions have no independent influence and although trade union representatives may sit on tripartite boards, they have no real input into either policies or programmes.

3.3 Skill upgrading

Under the terms of the Skills Development Fund, employers were encouraged to provide upgrading and retraining for industrial workers. But as we have mentioned, this fund is apparently not being used at the moment. Other skill upgrading is provided directly by the VITB, which offers part time training courses with substantial enrolment especially in the afterwork hours. "The VITB provides the central co-ordination and regulatory services such as testing and certification which support manufacturing and service industries and specialised skill centres".[37] VITB also provides curricula, instructional materials, and administrative facilities for enterprise-based training.

3.4 Attitudes toward change and innovation

The population of Singapore appears to be receptive to changes in its working situation, as demonstrated in part by the rush for higher qualifications in order to get better jobs. The openness to change is perhaps also encouraged by the population's heterogeneous origin and the Republic's tradition as a trading entrepot.

There are, however, problems with declining worker output and with job-hopping. The government believes that the attitudes of Singapore's workers are inadequate to meet the challenge of rapid high technology development, and it attempts to impose a manufacturing mentality. In November 1982 it publicised the importance of higher productivity among managers, supervisors, trade union leaders and workers by introducing a national "Productivity Month". In conjunction with this campaign, which was given to an advertising agency for slogan and jingle creation, was an increase in the number of management and supervisory training courses offered by the National Productivity Board, some of which were paid for by the Skill Development Fund. There are also campaigns to "remove the stigma of industrial work" through Apprentice of the Year and Top of the Trade competitions; these resemble the South Korean Skill Olympics.[38] Attempts are also being made to raise productivity by introducing the quality circles Japan has made famous. In Singapore, "workers have not rebelled against tighter constraints at work, and are currently being increasingly involved in the national effort to raise labour productivity".[39]

Probably because Singapore is so small, and also because of the government's publicity campaigns, there is an unusually high degree of public knowledge about questions of education and training, which in most countries would be a matter for specialists. Issues are frequently discussed in the newspapers, although there is some question about whether real debates take place or merely government position announcements. "The government, with its stable and highly competent civil service, has for a long time been educating the people in the problems and needs of Singapore given its special situation".[40] Surely this publicity contributes toward receptivity to new and experimental modes of both training and production.

4. Assessing the effectivenesss of Singapore's training and education

4.1 How well do current policies and programmes support industrial restructuring?

Singapore has supported its restructuring programme with all the necessary industrial infrastructure and also with the education and training needed to supply the firms with capable manpower. Planning and management of this massive effort have rested with the government with some input from the business community and from foreign investors in particular. Foreign governments have contributed less. There have also been investments by United Nations agencies.

It is unclear precisely how much the formal school system contributes to restructuring. It is clear that the bulk of training takes place outside schools, in the form of post-secondary advanced education or training in institutions, apprenticeship in industry, or some combination of these.

The Singapore government has not been able to make the employers' levy system (the Skills Development Fund) function effectively so far, although some funds were earmarked and used for the training of workers before the scheme was set aside.

A particular problem is that it is unclear precisely what Singapore needs in the high-technology area. This is particularly true because the multinational corporations with branch operations in Singapore, which are most likely to automate, do not locate their most sophisticated state-of-the-art technologies there. It may be that the investment in very advanced and

sophisticated training may not pay off in the end, and may show itself to have been an unnecessary expenditure. "Hence the prospect of frustrated expectations, and the related possibility of a future 'brain drain' of highly trained professionals is serious. (At present) there is an indication that provisions for skills training are often beyond the needs of employers".[41]

Another problem lies in the school system, which introduces early streaming or tracking based on language preference (Chinese or English). This "may undermine the goal of maximising the pool of potential engineering students...Moreover, since language learning encourages rote learning and memory work, emphasising it may lead to the neglect of analytical skills...An educational system that induces mental and behavioural conformity may discourage the individual creativity and originality required of design engineers".[42]

A final and perhaps very fundamental question to be raised about the education and training effort, is whether it is appropriate to train for manufacturing if the massive training input so far has not succeeded in reducing the decline in productivity growth, Perhaps "as much attention should be paid to the non-manufacturing sector as the manufacturing sector. Present efforts to upgrade the manufacturing sector should be continued. But...the manufacturing sector has created mostly unskilled new jobs. This pattern of job creation is unlikely to change significantly in the foreseeable future. Even in the highly industrialised countries, most industrial jobs are unskilled, requiring at most several months of on-the-job training".[43]

4.2 Policies which can anticipate and prepare for change

Education and training in Singapore appears intended to prepare for tomorrow's post-industrial society rather than today's industrial society. A future goal seems to be to make Singapore the "brain centre" of South East Asia. At the moment, however, there is an increasing problem of finding suitable engineering course applicants, and a broader problem of finding enough trainable manpower for post-secondary training that are required to reach the desired growth target. Only a policy which draws on nationals of other countries and offers them scholarships to study in Singapore would appear to satisfy this need, and this raises the problem of how to keep the graduates in Singapore for a sufficiently long time to make this investment

bear fruit. But, it is just this reliance on foreign input which the government of Singapore would like to avoid. Strengthening of advanced training opportunities for Singaporean women would be a possible solution, at least temporarily.

Conclusions and recommendations for further research

Perhaps the case of Singapore raises more questions than the other three countries studied for this report. We will briefly discuss them and also summarise some of the main characteristics of Singapore's industrial restructuring and education and training efforts.

Salient features of Singapore's industrial endowment are its large foreign and often multi-national investments, which means that restructuring will often involve companies and factories whose command centres are geographically distant. Clearly the problems of orchestrating restructuring under these circum. ances are not negligible. The government - which is well known to be highly centralised and administratively efficient - nourishes the hope of making Singapore a centre of high technology in South East Asia, with a forward-looking scientific and engineering establishment, capital intensive industry, highly trained professional and technical workers, and high productivity. For many multinationals, however, Singapore is principally attractive for its inexpensive and primarily female labour force willing to perform low-skill tasks.

One area of research is therefore the actual technological endowment of Singapore's producers, whether foreign or domestic, to engage in restructuring or technological upgrading. Some automation has in fact already occured, but how much in comparison with the restructuring which has already taken place in Japan or South Korea is not clear. The key question is the propensity to restructure, for it is this which will determine the demands placed upon education and training. Certainly the labour shortage in Singapore is a strong stimulus to restructure.

In line with the central government's determination to pursue national development, an extensive education and training network has been put in

place. Attendance at high schools has increased markedly, but there is some doubt about the quality of a high school education and there are presently attempts to improve quality. The government, jointly with industry in some cases and independently in others, provides technical training centres that teach the skills required by industry. Formerly most industry related training occured only on-the-job. There is also a full scale craft and technician licensing system administered by the VITB, a government agency, which both maintains its own training institutes and certifies skills of trainees from industry. Vocational training generally combines institution-based learning with practical experience.

But money allocated to vocational and technical training at lower levels has been reduced, while there may actually be a greater need for this training. This is because labour intensive manufacturing still employs the bulk of the work force. Many restructuring situations are instances of only partial automation of non-knowledge-intensive jobs. Workers and would-be workers must be taught to manage automated equipment. The sources do not tell us how this training or retraining is coming about. But they do indicate that it is the relatively unsophisticated kind of technical training which is most likely to be needed in a wide range of Singaporean firms in the near future. Again, only research which would assess the current extent of automation, and the outlook for the future, can address these issues.

Outside the school system, the Singaporean government is currently investing mostly in advanced technical institutes and in advanced university training. While in Singapore most training takes place outside school in post-secondary education or training institutions, or in apprenticeship programmes, the rationale for investing large sums in very advanced training is not clear. Is this a preparation for a hoped-for "very high tech" distant future for this small country while perhaps slighting the needs of today's industries? In this regard, investment in research and development is less than either South Korea's or Japan's.

It is not very clear to us how Singapore's advanced training system dovetails with its current industrial reality. We also lack details on how policies and programmes in education and training are formulated. The sources mention the many boards and government organs that make recommendations about training. But they tell us little about how these boards and bodies agree upon goals and initiatives, and how current programmes are evaluated.

Even though manufacturers and employers seem to do a substantial amount of training, especially retraining or upgrading, their input into policy and programme formulation appears to be purely informal, while trade unions appear to provide no input at all.

Many of these questions would be resolved by direct research. We would hope that this research would pay particular attention to women, who constitute the majority of the labour force in some industries but perform the lowest skilled jobs at the lowest pay. Yet more and more of these women, only some of whom are temporary residents with no permanent rights in Singapore, are high school graduates. They have much to contribute to Singapore's development, and will increasingly be the focus of many retraining and upgrading programmes in existing labour intensive industries as the drive toward higher productivity continues and more automation is introduced.

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Education and Training Policies and Programmes in Support of Industrial Restructuring in the United States.

Introduction

In the United States, two kinds of restructuring are occurring simultaneously. One is older and long-term, involving the decline of unprofitable industries such as steel and textiles - the so-called "smokestack industries" - with the consequent displacement of large numbers of low-skilled workers. The other is recent and stems from the rapid growth of "specialized" industries using advanced technology which imply a demand for highly skilled technicians and engineers, among others. There are sometimes overlaps between these two forms of restructuring. For example, the car industry has highly fluctuating fortunes and a changing skill mix; in part, traditional manufacturing technology and organisations are being replaced by newer, automated processes. The same is true of textiles and steel. In the first section, we will briefly describe the main kinds of restructuring taking place, and later we will come to their implications for education and skill training.

1. Industrial Restructuring: Causes and Strategies

1.1 The industrial restructuring effort

Industries in long-term decline have been contracting for many reasons. Some of these are internal to the United States, such as increased competition leading to overproduction, and rising costs, including labour costs. In addition, low quality domestic goods have led to a flood of better-made imports, which have attracted greater consumer confidence. External factors giving rise to the need for restructuring include lower foreign production costs and intensive international competition, and for a short time, a very expensive U.S. dollar.

In the U.S. there have been both widespread lay-offs of workers and plant closings. Frequently, entire U.S. production units have moved "offshore" to Southeast Asia, Mexico, the Philippines or elsewhere where labour is

cheaper. Other manufacturing operations have moved to "Sunbelt" states in the South and Southwestern U.S. where trade unions are infrequent.

Another response has been to demand higher U.S. protective tariffs against incoming goods. Such tariffs have enabled the textile and apparel industries to survive and even increase their output while reducing their workforce. These industries have also introduced advanced and automated production technology; indeed, U.S. companies have "been on a 'frenzy' of modernization and boast the most advanced textile plants in the world". In the steel industry, there are specialized mini-mills processing scrap which "pay their workers up to $9 an hour less than the unionized ones (and where) automation and new work practices have slashed labour needs. As a result, these firms have captured twenty percent of the total U.S. market".[1] Restructuring in the machine tool industry is a two-pronged effort involving specialization and also the manufacture and sale of entire computer-controlled manufacturing systms. Despite a recent increase in machine tool orders, there may be no concomitant increase in the workforce employed.

The car industry stands out for the speed of the technological changes occurring. General Motors, working with Japan's Fujitsu Fanuc, owns a state-of-the-art factory automation division whose robots are used in GM production units and also sold to other manufacturers. The number of labour hours now needed to produce goods has fallen drastically, causing permanent displacement for many workers. By 1983 there were some 450,000 workers in automobile and related industries who were unemployed, and many others were working part time. Recently, after having rehired or called back many of these workers, GM announced layoffs of 30,000 over the next two years and the closing of nine plants.

The most direct cause of this intense drive to automate and robotize in order to reduce production costs has been the influx of foreign-made cars on the U.S. market. The import share of the U.S. market for cars rose from four percent in 1960 to twenty eight percent in 1982, and may reach forty percent by 1990. For other goods (shoes, steel, apparel, consumer electronics and machine tools) it had reached respectively sixty, twenty-three, forty-one, ninety-five and twenty-seven percent in 1982 (AFL-CIO figures, 1983). When joint production agreements with Japanese companies have been reached, the intention will still be to produce "Japanese-style" at lowest possible

cost and with the least possible input of human labour. Other Japanese manufacturers such as Nissan are themselves now operating directly and independently in the U.S., thus increasing internal competition.

The employment consequences of this "invasion" have been massive. It may be, according to one estimate, that "fully one million American workers lost their jobs since 1978 due to the auto crisis (and that) in recent years over four million good jobs have been destroyed in basic United States industries".[2] Blue collar workers have thus suffered from unprecedented unemployment. "In a number of our states and cities, particularly in the nation's industrial belt, unemployment is quite literally at depression levels (and) shifts in the industrial goods market and other factors will result in substantial and persistent unemployment".[3] This unemployment tends to be restricted to certain geographical areas, which are in localised recession, and where blue collar unemployment reaches 16 percent at times. The workers who have been laid off are known as "displaced workers", and we will discuss their situation at length in regard to employment and retraining issues. Many U.S. retraining programmes are aimed at this category of workers, or at those about to be displaced.

Other geographical areas have especially benefitted from the turn to high technology, chief among them Silicon Valley in California and the Commonwealth of Massachusetts. The whole Massachusetts economy has been revitalized since the mid-1970s by investments in industries manufacturing and servicing computers, jet engines, medical instruments and other products, which brought some 50,000 new jobs to the state. "Unemployment rates that reached over fifteen percent as late as 1975 - nearly two thirds above the U.S. average - are now among the lowest of the industrialised states...High tech became to New England what oil is to Houston"[4]. The main source of skills and training for this knowledge-based industry has been the university research laboratories in the Boston area.

Manufacturing as a share of GDP declined slowly from 1960 to 1978, and there has been a strong turn in economic activity and employment towards the service sector. Within manufacturing "it is generally recognised that transitional unemployment and temporarily low capacity utilisation occur as some sectors and industries contract in the process of structural change, and

that slower economic growth and higher rates of unemployment make adjustments more difficult and costly". Other aspects of the problems of structural change "are generally not prominent in discussions of macroeconomic problems and policies...The structural problem that is perhaps the most recognised at the macroeconomic level is the relatively high rates of unemployment exhibited by relatively unskilled workers".[5] It is interesting that what is perhaps the best book on displaced manufacturing workers has been published by a manufacturers' association.

1.2 The government's role in restructuring

Like other economies studied for this report, the U.S. economy is largely private and most economic endeavours are investor-owned and profit-seeking. The process of structural adjustment is determined by market forces, and "government assistance to particular sectors, industries or groups is limited by the commitment to market solutions, the opposing positions of competing special interest groups, and the relatively cumbersome process of formulating and implementing government policies".[6] Although there may be occasional calls for an "industrial policy", in reality "government planning is counter to the prevailing ideology" and government policies such as tax breaks, pollution control measures, industrial revenue bonds, and equal employment opportunity laws are almost always made available without regard to the industrial sector concerned. "When structural adjustments become necessary, particularly as a result of external competitive shocks, the affected industries will frequently clamour for protection, in part because other avenues of adjustment through direct government intervention are not open to them...Protection may indeed be afforded, but only after a protracted political contest against opposing interests and against the prevailing ethic of a freely competitive market...The general sentiment 'shape up or ship out' is a powerful force"[7] and "direct subsidies to prop up inefficient firms and industries are generally avoided".

The Director of the Office of Productivity, Technology and Innovation of the U.S. Department of Commerce has clearly stated the U.S. structural adjustment situation. "It is abundantly clear to us that our economy is in a major transition. Three major forces will drive this transition in the 1980s: The worldwide technology explosion, industrial targeting strategies, and the demographics of the workforce...We have two economies today, one that

is very capital-intensive, technologically obsolete, and low in asset turnover. It has overcapacity in terms of supply-and-demand relationships in the world. At the same time, some sectors of our economy have reported record sales, record earnings, and record hirings for the past two years. This indicates there is a tremendous dynamic structural change going on within the economy. The net effect of this is going to be positive from the standpoint of improving productivity, creating jobs, increasing exports, and improving our quality of life".[8]

Aside from its military contracting agreements with particular private industries, virtually the only way in which government influences this process is through education and training , and we take up this subject in Part 3.

2. Industrial restructuring and the workforce

2.1 What workers do, what workers know

2.1a What workers do: changes in the distribution of labour

Of the four countries studied for this report, the U.S. has the lowest percentage of its working population in the agricultural sector (four percent). The proportion of the population in manufacturing is also now declining, although manufacturing and other industrial jobs accounted for about 43,000,000 workers in 1979 - some forty-one percent of a workforce of 105,000,000. However, "industrial jobs" in our source undoubtedly includes some service-oriented jobs.[9]

In 1982, more than seven out of ten jobs were in service industries.[10] In the recessionary period 1979 to 1982, the total loss of manufacturing jobs was about three million. Most of the lost manufacturing jobs will not be recovered; and while umemployment has been running around seven percent recently, it is much higher in the manufacturing heartlands. There has been some growth in employment in certain industries, for example mining and construction.

The U.S. labour force is almost equally divided between males and females, and labour force participation is now around sixty-four percent of the total population.[11] Labour force growth is expected to come from the

addition of early career workers aged twenty-five to thirty-four years. This growth as a whole is expected to slow to 1.5 percent by the end of the decade since "6.85 million fewer workers will be entering the labour market than would have if the old labour force growth rate were in effect...The population base for two potential problem groups will be decreasing. The young workers are disproportionately represented in the disadvantaged worker group, and the older workers are most seriously at risk from job loss due to displacement".[12]

2.1b What workers do: changes in occupations

There has been a "shift away from older, often labour intensive industries such as textiles, garments, and consumer electronics" employing relatively unskilled blue collar workers.[13] Craft workers, with more skill training, increased by 1.7 million between 1972 and 1980. The increase in jobs for professional and technical workers and for clerical workers (most of whom are in service sector jobs) was much greater during the same period, and managers and administrative positions also increased. But more recently there have been declines in the number of management and administrative positions, particularly in manufacturing. Similarly, declines have begun to affect professional and technical workers in the service industries. "This may reflect the increasing impact of new office technology - including the very recent development of some expert system computer programs - on middle-level skills...Finally, office automation continues to have a heavy negative impact on the numbers of jobs available for lower-level and, more recently, higher-level clerical workers in all industries".[14]

Within manufacturing, the only sectors to have avoided either a static employment situation or a decline have been printing and publishing, drugs and medicines, petroleum refining, non-electrical and electrical machinery, and professional goods. The industries most affected by adjustment are low-wage industries where there is also low productivity and in which the U.S. is uncompetitive internationally, and higher-wage industries where wage rises outstrip productivity. Employers in high technology industries, on the other hand, had staffing problems in the late 1970s, especially in engineering and technical operations. There is little transferability; the workers from depressed industries seldom possess the skills and knowledge needed to make the transfer into this growth area.

There are, in fact, "partioned market segments" in the labour market by skill category and geographical area. "Workers in industries that are adversely affected by trade are less skilled, less educated, older and more likely to belong to a minority group, and it is these very characteristics that reduce the likelihood of successful relocation".[15] The steel, car, textiles and apparel industries tend to have large numbers of minority and female workers with relatively low skill endowments. While the need for operatives has declined, there has been an increase in that for craftworkers.

The relative increase of service workers has occured especially in health and education, retailing, consumer financing, and product servicing. Financial advising and consulting activities have also grown in the past five years.

2.1c What workers know: changes in the knowledge, skill and qualifications profiles of workers

There is a mismatch between existing jobs and the knowledge and skills of many workers in search of jobs. The restructuring which has occured has not induced major changes in the knowledge, skills and qualifications of those workers most affected by it. To quote an ILO report, there is "a similarity of qualifications of workers displaced by import competition - or by more advanced machinery introduced in response to import competition (which) is aggravated by the regional concentration of some of the older import-threatened industries...Workers displaced by import competition in the United States do not have the same skill levels as those hired by export expanding industries".[16]

At the same time, the employed workforce as a whole has higher skills. The ILO study contrasts the twenty industries upon which trade had the most favourable impact on job opportunities with the twenty industries in which trade had the least favourable impact. In the first industry group, skilled workers constituted 55.8 percent of the labour force, white collar workers 36.3 percent, and scientists and engineers 6.9 percent. In the second group, the respective percentages for these categories of workers were 38.8 percent, 21.1 percent and 2.29 percent. The averages for the entire manufacturing industry were, respectively, 50.0 percent, 30.3 percent and 3.20 percent.[17] These figures clearly how that flourishing industries are using skilled workers, white collar workers, and technicians and scientists, while the declining industries use, on average,

lower skills. There is no indication in the literature that large numbers of recent employees of the declining industries have upgraded their skills to fit the requirements of the flourishing industries.

Recent labour force adjustments in the area of skill and knowledge changes may be summarised numerically as follows: There was an increase of 10,000 engineers in only two years (1980-1982), to bring engineers in the labour force to a total of over 1.1 million; "engineers comprise nearly a third of professional and technical personnel across the manufacturing sector". There has also been an increase in engineering technicians, computer programmers, and NC tool programmers to reach a national total of about 1.3 million. "The fact that growth of technician employment in manufacturing between 1977 and 1980 exceeded the growth rate for both scientists and engineers...suggests that technicians are being substituted for other types of personnel..(as they) can and do perform work that previously was considered either professional or skilled trade work".[18]

It is important to mention here the "alarmingly high rate of illiteracy among American workers - one adult in seven in the 1970s".[19] Many "lack the levels of knowledge and skills needed to qualify then for skilled or even semi-skilled occupations".[20] Many students withdraw from high school even before completing their high school education and "acquiring adequate basic skills".[21]

2.2 The skill and knowledge implications of industrial restructuring

2.2a The introduction of new technologies: skill and knowledge implications

As already discussed, a common way for industries to attempt to meet foreign competition is to automate, and this is true for both declining and flourishing industries. The implications for skill and knowledge requirements in both cases are similar. According to employers, the skills needed are becoming more specialised and knowledge-based, and they include advanced technological awareness, computer skills and electronics; intellectual skills; robotics skills; and higher-level reasoning and trouble-shooting skills.[22]

There is, then, a new need for "knowledge" workers and a concomitant decline in the number of production workers, who are "less likely to have

college training...(and) tend to acquire these skills on the job rather than through outside training".[23] The decline in workers with this kind of training background has affected operatives most and spared craft workers, who account for 18.5 percent of manufacturing employment. With the introduction of programmable automation, these workers "will need broader skills than before because maintenance of automated equipment has been added to other maintenance work" and there are also workers needed for "setup, supervision, inspection, adjustment".[24]

The displacement effects of automation on production workers of various kinds are far from uniform, and far from perfectly understood at present. But "the directions of change are clear. In some cases, the effect will be to reinforce the long-term shift toward white-collar employment" - engineers and computer scientists, technicians, mechanics, repairers and installers. Declining categories will be production workers (except mechanics), "especially the least skilled doing the most routine work"; clerical personnel; and lower and middle management pesonnel.[25]

The new technologies also introduce a growing need for constant retraining, as the rapidity of new technical developments "will make managerial and technical skills obsolete much more rapidly. Management will need to update its skills constantly and understand the impact of these new technologies. This will mean retraining - a constant transition in the labour force". The ability to compete successfully on a world scale implies "strong management and a strong labour force with the skills and competence to improve productivity and take advantage of new technological opportunities...We stress the need for increasing the quality of engineers and computer scientists and encourage efforts to bring more competent people into these professions...We also emphasise the need to help workers modify or augment their skills in ways that will permit them to move from one job to another, or from one industry to another, during this decade of economic transition".[26]

One study of the subject finds that "the combined effects of technological and economic change are also having pronounced effects on the expectations individuals and employers have for instruction as a tool for personal and professional growth. These expectations take the form of increased demands for specific kinds of instructional programs and services...Some of the new instructional demands emerge from changing skill

requirements in particular working environments. Other instructional demands reflect the impact that technological and economic change is having on society as a whole".[27]

The following figures give some idea of the estimated demand for various specialisations associated with rapid technological change, according to the Bureau of Labour Statistics. The demand for scientists and engineers will increase by forty percent between 1978 and 1990; mathematical and physical life sciences will see the creation of 180,000 new jobs, 480,000 new positions will be created in the computer professions and 250,000 in engineering.[28]

2.2b The introduction of new technologies: changes in company and work organisation and job content

An outstanding report on computerised manufacturing automation writes that "the impact of programmable automation on the work environment is one of the most significant, yet largely neglected issues. Depending on how it is designed and used, PA can substantially change the nature and organisation of the manufacturing workplace, and consequently influence levels of job satisfaction, stress, skill and productivity".[29] Principal variables seem to be whether the automation is extensive or restricted to selected operations. Inevitable seems to be the deskilling of some workers as their jobs are replaced or partly replaced by machinery, and ultimately perhaps the creation of a "two-tier" workforce. Many manufacturing operations may be computer-controlled from a central place, and it is predicted that workers at virtually all levels will yield up some of their autonomy and capacity for initiative as these qualities will no longer be in demand. At the same time, the workplace will become physically safer for human beings.

In declining industries that have moved offshore, the progress of automation appears to be far less, most operations being labour-intensive and light assembly and done primarily by low-wage women workers. The displaced workers remaining behind in the U.S. will only experience changes in work organisation and job content to the extent that they find new jobs.

3. Education and training policies to promote technological innovation and structural change

The education and training system in the U.S. is both school-based and enterprise-based, and there is also a growing input from the trade unions. In Part 3 we will first describe the school system's contribution to preparing young people for structural and technological changes. We will then deal with other areas in which government policies may affect education and training, and subsequently discuss enterprise-based training.

3.1 The government's role: the education system and formal training

Of all four countries studied for this report, the U.S. has least national government involvement in education and training for employment, since the U.S. constitution gives total responsibility for education to the separate states. "The only way the federal government can influence education in the states is by funding special initiatives. Despite many such special initiatives funded over the years, all agree that the United States does not have a national policy, plan, or program for education and training for employment".[30] The federal role consists of supplementing local initiatives, and "in recent years there has been a movement toward lessening direct federal involvement".[31]

The government involvement in education which counts, then, is state and local, not national. Where training is concerned, federal input often consists of grants to local agencies rather than direct administration of training programmes.

Enrollment in primary and secondary education is virtually 100 percent of the appropriate age group, although enrollments have been declining as the relevant age groups have become smaller. There is also a high school dropout problem. In the average high school there is little or no specialisation or skill training, although some public secondary schools have vocational programmes in the public secondary schools (with a total enrollment of 10.5 million students).

Serious criticisms have been raised about the adequacy of the high school system in preparing students for further studies or employment. In 1983, the

National Commission on Excellence in Education claimed in its report "A Nation At Risk" that thirteen percent of seventeen-year-olds were functionally illiterate and could not read at a fourth grade level, with functional illiteracy among minority youth reaching forty percent. Most students at this age had trouble using basic mathematics to solve problems. Remedial mathematics courses in public four-year colleges were increased by 72 percent between 1975 and 1980 and now constitute a fourth of all mathematics courses taught in these colleges.

Criticisms against the secondary education system include poor teacher training and preparation. The academic standard of teachers is said to be poor. There are shortages of instructors in mathematics, science and the technical fields, and there is low student participation in science and mathematics beyond the tenth grade. Equipment is outdated. Instructional programmes at all levels receive less government money. The poor level of student preparation is not new. A test of 2,134 unemployed workers prior to enrolling them in training programmes showed that 710 workers "did not have the minimum skills of a seventh grader. Their mathematics reasoning was between the fourth and sixth grade levels. Forty-four percent of these workers were from 35 to 44 years old. 444 claimed to be high school graduates. Their reading ability was ranked at a fourth to sixth grade level".[32]

At the same time there is a "growing national awareness of the importance of education, training, and retraining to international economic competitiveness (and) concern over the current state of elementary, secondary, and post-secondary instruction...Individuals and employers are demanding more from education, training, and retraining programmmes and related services".[33] However, the National Science Foundation's Public Understanding of Science Program recently released a report referring to "the increasing gap between the relatively small technological elite and the far larger public that is both poorly equipped to understand new developments and is effectively precluded from significant careers related to science, engineering and high technology".[34]

"Training for employment (whether for conventional jobs or for advanced technology jobs) usually takes place in either secondary schools (vocational programmes) or in post-secondary institutions (technical programmes)".[35]

The post-secondary institutions are either technical institutions or schools offering two- or three-year courses which prepare students for employment in moderately technical occupations. There are also junior colleges or community colleges which either provide "semi-professional" qualifications or lead to four-year institutions. The four-year post-secondary institutions' enrollment have been dropping in recent years after having reached a level as high as one out of four labour force participants in 1982 (as opposed to one out of seven in 1972).[36] But many four-year graduates faced a tight labour market in the 1970s, and there is now a strong preference for two-year community colleges or technical schools which give either an associate diploma or a vocational certificate. In 1981, the two-year colleges enrolled thirty-two percent of all post-secondary students, up from twenty-seven percent in 1970. Some science graduates from two-year institutions have problems finding jobs since their training is insufficient compared to the "high tech" needs of industries. Currently pending in Congress is a Mathematics and Science Education Act to strengthen the quality of secondary and post-secondary teaching on these subjects.

Female participation in post-secondary education has increased in recent years, while male enrollment has remained constant. Enrollment of minority groups reached 16.5 percent in 1980. Almost ten percent of students were black and four percent Hispanic. "These data suggest that post-secondary institutions are now serving a much broader audience and perhaps a wider variety of instructional needs". In vocational education, post-secondary enrollments reached 6.4 million in 1980.[37]

Although we have treated all secondary and post-secondary institutions under the "government" heading, the variety of governmental and non-governmental agencies involved in planning and implementing programmes, including those which train for advanced technology, is large. At the secondary school level, state boards of education are probably foremost in planning. Beyond this level, post-secondary boards of education or the institutions themselves may decide which programmes to offer and which professional or skill specialisations to encourage, basing their decisions on the needs of their service area, which might vary greatly in size and constituency. "Typically, these institutions have staff who are well qualified to conduct survey research and other kinds of studies needed to discover which new programmes should be offered".[38]

These planning bodies are not all public. In fact, about two-thirds of the four-year institutions and one-third of the two-year institutions are private, although they may receive government aid for both educational programmes and directly to pay student tuition. The courses they offer are a significant input into the total U.S. education and training system, as are those of other private sector institutions which give various kinds of technical and professional training on a profit-making basis. "The proprietary training institutions typically provide a high-quality education. Frequently, they produce a better-trained worker than do the public vocational schools and technical institutions...Learners choose to attend proprietary schools because the quality of training is high and the learning period is brief".[39]

One major form of government involvement in education and training is the retraining of older workers and displaced workers. These programmes are increasingly perceived as the most constructive means to support industrial adjustment processes. Sometimes, the government at various levels collaborates with industry and the trade unions. Some of these joint initiatives will be discussed below.

"The federal role in training and retraining efforts - particularly for the economically disadvantaged - has been a dominant force since the 1960s".[40] The main vehicles today for federal input in this area are the Job Training Partnership Act, which went into operation in 1983, the more recent Carl Perkins Vocational Act, and the much older Vocational Education Act of 1963, which mandates funds to the states for secondary and post-secondary educational training, to be used by different kinds of institutions for different purposes. The Job Training Partnership Act's Title III "authorises the expenditure of funds for retraining and related services for displaced workers". This funding is administered at the state-level "through a network of local private industry councils".[41] In 1983 $110 million was appropriated by the government.

The government has also given money to a special project in the Detroit-area known as the Downriver Community Conference, a public, community-based, non-profit organisation that enrolls workers laid off because of plant closures in the car, steel, rubber and related industries. In addition to job search assistance and other services, classroom and on-the-job training is provided.

"The stated objective of the progrmme is a simple one - to return these workers, as soon as possible, to quality jobs".[42] The Federal Employment and Training Administration gave $5.2 million for this project, and in 1982 the Department of Labour began to finance six similar pilot projects in different parts of the country for a total cost of $7 million. "This new effort is expected to serve nearly 4,500 dislocated workers...all of whom have suffered large lay-offs from major local industries."[43] These contributions are only 'seed money, however, and will only reach a small percentage of the workers expected to be displaced. "Moreover, the programme is encumbered by restrictions that will hamper the effectiveness with which even these limited funds may be utilised...Congress should require...income maintenance" during the training period to enable longer-term training, and other supportive services".[44]

To conclude this section, the Job Training Partnership Act "shifts responsiblity for administration and regulation of federally funded training and retraining activities to the states"[45] and strengthens private sector influence in programme planning and administration. A growing role is also envisaged for the community colleges, some of which (for example Parkland Community College of Champaign, Illinois) are opening Dislocated Worker Assistance Centres which give training and retraining, often with industry input. Indeed, a Job Training Partnership Act survey conducted in late July 1983 revealed that 83% of the responding community colleges had Private Industry Councils (PICs) formed in their areas; retraining is geared toward the skills needed by area businesses.[46]

Other government financing of training for displaced workers is embodied in the Trade Adjustment Assistance Act of 1965, which gives special protection to industries undergoing restructuring, and especially the car industry. But the training funds available under this legislation are rarely used.

3.2 Industry's role: the enterprise in education and training

"The urgency of maintaining an adequately trained workforce is of critical concern to company managers...In America, public sector education and training institutions have provided citizens with a broad general education. Business or industry then employ such persons and deliver a small amount of pre-service training necessary for the new employee to do the job. Later in

life, the employee often receives in-service training whenever promotions or changes in job skills make it necessary".[47]

The various forms of industry training include on-the-job training, special in-house training programmes, and the creation of corporate educational and training facilities (including corporate-sponsored colleges which sometimes confer recognised degrees). According to one estimate, private employers spend $30 billion per year on training their employees, but "large as this number is, there is reason to believe that it is still less than the socially optimal level of investment for the American economy. Due to the presence of what economists refer to as 'private market failures', the American private sector persistently underinvests in developing the skills needed by its own workforce. These market failures hamper both investment by employers in training their current employees and employees' investment in training themselves".[48]

Many industry-led initiatives do have some government financing, principally in activities like upgrading and retraining, and it is difficult to separate out completely industry's input in this area from that of the government. The ECIDA-General Motors programme in Buffalo, New York is a case in point. ECIDA is an area private industry council having $400,000 of federal financial support from the U.S. Economic Development Agency. Its total budget, based primarily on industrial financing, is now $120 million. It used some of this money to run two training programmes at General Motors: one which trained 400 managers in quality circles, and another which introduced 1000 assembly line workers to robotics in preparation for starting a new engine-assembly line. "As a result, a permanent training centre was developed at the GM plant. We found that the joint efforts of economic developers, the private industry council, and others had a significant impact on the upgrading process in many of our industries. The private industry council has become one of the foundations of economic development in the community".[49]

Other industries are upgrading workers with the help of trade unions. An example is the Ford-UAW agreement. UAW, i.e., United Auto Workers, also has agreements with General Motors. At Ford, money is being used for training crafts personnel in robotics and computers. "This type of training is very significant because it enables workers to continue their careers and to move

up the career ladder using the new skills and the technologies that are involved on their place of regular employment".[50] The UAW-Ford National Development and Training Center (NDTC) is located at a community college in Dearborn, Michigan, and was established in 1982, at a time when there were many lay-offs and firings at Ford. Both active and laid-off workers attend the retraining programmes, so that the centre is retraining both for development within Ford and for outplacement of workers who will not return to Ford.[51] Other specialised programmes are aimed solely at permanently laid-off Ford employees, providing vocational retraining. Money comes from the trade union (UAW), Ford, and the state of Michigan. There are local training and development projects in the south-eastern part of the state which rely "on a network of existing educational institutions and local community resources to provide...counselling, education, and retraining".[52]

Jocelyn Gutchess writes that "the UAW-Ford Employee Development and Training Programme, in which more than 12,000 employees from Ford locations throughout the country have already participated, is an experiment well worth watching".[53] Gutchess also provides a description of a "novel experiment" in the state of California, in which industries, under the aegis of a state government agency, are drawing upon unemployment insurance money to retrain workers who are unemployed or who would otherwise have been laid-off. "To date, a total of $67.8 million has been committed to training more than 200,000 people".[54] Monies from the state's general fund are also funneled to employers and industries for upgrading their own work forces. These programmes have stimulated the state's economy and convinced businesses to remain there rather than settle elsewhere. The programmes comprise a broad range of retraining projects and target populations.

Other joint initiatives of industry and trade unions include the Joint Skill Development and Training Programme of General Motors with the United Auto Workers, This training is aimed at both GM workers who, it is hoped, will remain on the job, and also those who have been or will be displaced by the company. Both kinds of training aim at skill enhancement to meet the challenges of new technology; the retraining of displaced workers draws upon collaboration also with state and local bodies to provide training and other supportive services. In other words, "A comprehensive project was established to address the needs of the workers within the context of labour market demands; that is, all services and retraining were structured to respond to project employer demand for the skills and occupations calling for workers'

skills".[55] An individualised retraining plan is made for each worker requesting retraining, and openings in training courses or, sometimes, on-the-job training are located. The whole $40 million-a-year programme is directed by the union and the corporation. Our source writes, "GM's retraining programme illustrates the somewhat limited impact even the best-designed, fully funded projects may have".[56]

The same two-pronged training approach - to upgrade the skills of employed workers and retrain displaced workers for outplacement - is followed by American Telephone and Telegraph Company (AT & T) and the Communications Workers of America. The training is optional and on the employee's own time, and is overseen by joint management and union advisory boards. "These and other provisions of the agreement are designed to enhance the flexiblity of workers in an industry that may require constant retraining as technologies change".[57]

In the car industry there is also the UAW-Buick Employee Development Center which, like the Ford Center, "is supported by a negotiated company contribution to a jointly managed fund. It was developed by the company and union working together and provides up to two years of retraining for Buick workers who will be displaced by the introduction of new technology (for example, robots), designed to maintain the company's ability to compete in international markets".[58]

Some firms, of which IBM is one example, attempt to hold onto workers but use them flexibly, in the presence of changes in production organisation and technology. By means of continuous training and retraining, the firms hope to produce greater worker flexibility and avoid lay-offs. Unions have also greatly supported such employment security programmes.

Industry training and retraining programmes are often the outcome of negotiations with the relevant union. On other occasions, they are the product of co-operation to meet the urgent needs of displaced workers. It would be helpful to know the magnitude of the training and retraining which is presently occuring, but figures are not always available. Under the UAW-Ford pact, 12,000 employees have already participated and there are 41 targeted vocational training locations. The UAW-GM programme has enrolled 2271 workers, although 2906 workers were referred to training. This is a low

figure in the light of the many thousands of car industry workers who have either been displaced or run the risk of displacement over the next several years.

Another increasingly common method enterprises use to train or upgrade their workers is to subsidise the tuition for further coursework in either public or proprietary institutions. Around 42 percent of the men and a quarter of the women who take such courses have been reimbursed in this way. Each course costs the student approximately $120 on average. In 1981, nearly one quarter of the courses chosen were in the business field and another 10 percent were in engineering. Over one half of the 21 million students taking such courses were participating for job-related reasons. "Approximately 54 percent of the adult education courses were provided by schools; the remainder were offered by industry, community organisations, government agencies, and others".[59] This kind of enterprise participation in further training can be used to retrain workers to do different jobs within a company, as an alternative to lay-offs. In some cases, the retraining takes place within the enterprise itself, conducted by an external contractor.

As in other countries, the training situation in U.S. enterprises is very different from firm to firm, ranging from the extreme of no training which was found in Buffalo, New York ("Companies here had very little commitment to training, people simply went to work. Companies didn't worry about training them"[60]) to whole corporate-sponsored "universities". It is difficult to separate out training for upgrading purposes from training to avoid lay-offs and firings. The retraining centre General Electric began constructing in 1983 as a part of its Erie, Pennsylvania locomotive works is a case in point. A company-supported training programme would arrange for the "redeployment" of staff to different positions as a way of dealing with potential workers' displacement.

Trade unions have been unusually active in many of these situations; "Nearly 50 percent of today's bargaining agreements cover such matters as transfer rights, relocation assistance, retraining, and health and welfare benefits".[61] There is "a growing realisation by labour and business that they have a mutual interest in improving the competitiveness of the firm and in enhancing employment security. In many firms and in some industries, one or both parties recognise that co-operative strategic planning can minimise the disruptive effects on employees without unduly delaying

productivity-enhancing improvements".[62] However, for employers, "the decision to invest in workers training, as with any other investment decision, depends largely on the expected return from the investment. When workers are free to move from company to company, it is risky for an employer to spend thousands of dollars to give a worker a skill in great demand, because that firm's competitor will try to hire that worker away the minute the training is complete. When all employers together react to this fact, a situation arises in which everyone needs a skilled labour pool but nobody will pay for it".[63]

The retraining of older workers who are already unemployed or are about to be made unemployed through industrial restructuring is particularly difficult, because "under current American regulations the unemployed lose benefits if they accept this type of retraining (on-the-job training)".[64] Only 17,5000 people took advantage of the training funds associated with the federal government's TAA programme for workers adjustment assistance from 1975 to 1979.[65] Neither the recent Job Training Partnership Act nor (in most states) the unemployment insurance programme will provide income maintenance during retraining. Also, "because formal mid-career training is very expensive, individuals may be reluctant to undertake such a sizeable investment when there is no certainty that it will pay off".[66] Nevertheless, in 1981 over 21 million people were enrolled in adult education programmes, representing an increase of 17 percent over 1978. People with some post-secondary educational experience are most likely to attend these programmes.

Most retraining is sponsored jointly by the community or locality, with state and federal government and industry aid and support. Examples of his kind of collaboration are the Illinois retraining programmes for displaced workers and the dislocated worker training programme in Alameda County, California. The Illinois state government is using Job Training Partnership funds to set up 15 mini-projects throughout the state, modelled after the Downriver Community Conference in the Detroit area. The Alameda County retraining venture involves four partners - General Motors, United Auto Workers, State of California, and the Alameda Private Industry Council. "Funds totalling $9.5 million consist of a $1.5 million demonstration grant from the U.S. Department of Labor and $4 million from the GM-UAW Training Fund, which will be matched by the State of California". The programme itself "is employer driven. The private industry council gave us clear job

commitments or pledges from employers. Once commitments are made, we...negotiate performance contracts with private and public providers of vocational training".[67] The goal of this project is to enrol some 40 percent of the area's displaced workers. Other retraining efforts are run by community colleges. The Continuing Education Department of the Community College of Allegheny County, Pennsylvania is doing significant retraining of displaced steel workers. The industries themselves also do retraining. Bethlehem Steel in Pennsylvania is retraining for out-placement with the aid of the federal and state governments and the private industry councils. Still other retraining efforts are union-sponsored. One example is SASMI, a fund for retraining union construction workers in the sheet metal industry. Within the high technology area, some training is offered by the vendors of robots and automated equipment, but these are short programmes lasting up to three weeks.[68]

These retraining initiatives provide new or upgraded job skills for relatively few workers. To give some idea of the size of the effort needed, the investment in robots is expected to approach some 100,000 by 1990, with a displacement over a decade or so of well over one million workers in the car industry alone. Between 25 and 30 percent of the new robots will be installed in the car manufacturing industry. Worker displacement, upgrading and adaptation to modernisation and robotisation in the car and selected industries are therefore among the most crucial retraining problems to be tackled. At present, the initiatives depend on the goodwill of specific companies and specific local and state administrations, as well as on the federal government. The budget under consideration for adoption in 1987 by the national congress will further cut allocations for education and social services.

One source cautions that displacement by robots is "only a small part of the total automation picture" and also that "the obstacles to retraining displaced workers include the nation's inability to count them accurately and, in some cases, to find them. A Congressional Budget Office Study (1982) put the number anywhere from 100,000 to 2 million".[69]

3.3 Attitudes toward change and innovation

The problems here seem to be of three kinds: resistance to change, lack of proper preparation for change, and lack of adequate training and instructional materials. These may be combined in a single situation.

Individuals and even entire organisations can resist change. Responses to changed requirements for education and training are usually gradual, and there can be a failure to respond rapidly to emerging technologies, which may be overcome with proper preparation for change. A Carnegie-Mellon study focussing on "the individual reactions to the introduction of robots at a metal alloy plant" found that the 1000-member blue collar workforce had "a complete lack of employee awareness about robots" despite efforts by management to prepare for the introduction of the robots. The employees "felt that new skills in programming and detecting problems in robot operations were needed".[70]

Lack of proper preparation for change shows up in training as well as on the job. "Many educators have difficulty keeping up with industrial advances", so that training cannot necessarily be relied upon to transmit state-of-the-art skills and knowledge. Both schools and industrial training institutes also decry a lack of training resources and the inability, in cases, to hire more trainers. "The solution to this problem...is increased resources allotted to educational institutions and industrial training organisations".[71]

Displaced or potentially displaced workers who find their jobs disappearing during the processes of industrial restructuring react differently. They frequently resist change by attempting to forestall plant closings or - in other circumstances - technological innovations. These reactions may be short-lived, and are often followed by a host of well known social, physical and psychological stresses and strains as formerly employed persons try to come to terms with the new reality. The negative effects of plant size reduction or outright closing are frequently exacerbated by the "one-company town" phenomenon, as there may simply be no other employer available in the area, no matter how many saleable job skills an applicant has. Many of the programmes just described have a counselling component which helps individuals deal with their problems.

The positive attitudes toward restructuring which are found in the Asian countries seem to have little parallel in the U.S. For one thing, there is little national understanding of the need for industrial readjustment; there is no national industrial policy which can be called upon to rally employers' and workers' energies and enthusiasms. Restructuring remains sectoral or

regional, governed solely by private decision-making and investment criteria, and followed primarily by the manufacturing and investment communities. It is not a process in any way directed by the government or the workers and their unions, and there is therefore little knowledge of it and no identification with it. This despite the recent and widespread acknowledgment that U.S. manufacturing industry had lost much of its competitiveness due to low productivity, although in 1986 this productivity began to show some improvement. The solution to the U.S.'s industrial problems advocated in many quarters, especially among the public at large, is "Buy American" protectionism rather than long range industrial modernisation. There is also little personal drive to engage in self development which would bring about individual adaptation to the changing industrial reality. For example, those most "at risk" due to technological and economic changes are those apparently least predisposed to enroll in courses that may lead to new skills development.

4. Assessing the effectiveness of U.S. training and education

4.1 How well do current policies and programmes support industrial restructuring?

This section deals mainly with training for new technologies, but it begins with some general observations about the educational system. Earlier we noted some of the serious shortcomings of this system. Now we ask the question: How well does it prepare for work in the rapidly changing industries?

A survey of representatives of industry, labour and the educational community presented differing perspectives concerning "how well local school systems prepare individuals for work, as well as on specific competencies based on basic mathematics, science, and communication skills. Survey results revealed a great disparity between industry, labour, and educators' views of what employers have a right to expect of employees. The industry and labour respondents had much higher expectations in the area of practical, basic competencies than did the educators...(many employers) want an instructional system that produces individuals who have a strong foundation of reading, mathematics, science, and communications skills; or possess core occupational or professional skills; and who have acquired analytic and problem-solving abilites that will enable them to better adapt to workplace change".[72]

There is some indication that the need for educated manpower in industries undergoing restructuring is not being met. Three separate reports "all recommend a reassessment of the U.S. educational curriculum in light of changing world conditions, including the growing use of advanced technologies in the workplace...The relationship between education and training and economic expansion has recently become a focus of national attention...Industry, labour, and government leaders all recognise that a highly developed human resource pool is critical to maintaining U.S. competitiveness".[73]

The same theme occurs in another observation. "On the whole, the U.S. instructional system may not now be able to accomodate the potential demand for PA-related skills...Shortage of technical instructors, state-of-the-art equipment and other resources are major problems for all segments of the instructional system, including industry-based education and training...(There is also) considerable pressure on the U.S. instructional system to be more responsive to structural economic change. Economic and technological change may well result in more frequent shifts in workforce skill requirements, and it may well require greater flexibility and mobility among workforce paricipants than ever before. The ramifications of programmable automation for education and training are a subset of this larger issue".[74]

Workers who are directly threatened by industrial readjustment, and who would most benefit from retraining courses, may find no courses available in their area. Nor is there a "central place" that would link the various educational and training opportunities with labour market openings and diffuse information about the skills and specialities in demand.

The absence of national labour market co-ordination mirrors the absence of national co-ordination of the educational and training system. "There is frequent duplication of effort and competition for funds...(and) adequate planning, co-ordination and articulation do not always exist between vocational and technical education".[75] However, "our disjointed, non-centralised approach to planning for advanced technology seems to work fairly well, despite its shortcomings". "The federal government makes its influence felt by allocating relatively small amounts of money to each of the 50 states for use in developing programmes in certain, selected categories...but does not make much money available to support on-going vocational and technical programmes. Actually, this is precisely the

intention of the federal government".[76] Such funds are often administered jointly - as are many programmes - by consultative bodies composed of labour union members, educational authorities, and enterprise representatives.

The Government Accounting Office just completed a study of eighty federally sponsored job-training programmes for displaced workers, and found that programmes sponsored by employers and/or trade unions were three times more likely to have above-average placement success than those run by state agencies and other organisations, principally because company and union officials can help jobless clients more easily by using contacts with local employers. But the study found little difference between the success rates of programmes that emphasised classroom training and those that stressed on-the-job training.[77]

The problems of U.S. education and training for high technology stem from both the education and the training parts of the system. "Neither the industrial nor the educational sector alone has fully met all PA (programmable automation) training needs identified to date, nor has either solved all the major problems associated with the delivery of such training. Some of those needs and problems are, in fact, common to both industrial training and the instruction delivered in educational institutions".[78]

One other shortcoming to be mentioned - and one the U.S. has in common with the other countries discussed in this report - is the lack of managerial training and competence among technical personnel. Traditional engineering programmes do not stress the need for the developing management competencies; nor do other technically oriented training programmes.[79]

4.2. Policies which can anticipate and prepare for change

There are two special client populations for education and training, aside from the general public: the growing pool of displaced workers, and workers who need training for the high technology industries. The needs of these two populations partly overlap - as do the populations themselves - and both must benefit from "training and basic education programmes designed to meet the immediate and projected needs of existing and emerging businesses and industries".[80]

Workers in high technology and automated environments must have a combination of education and on-the-job training or retraining. "By definition, school-based programmes cannot hope to prepare workers for the most advanced skills needed in companies that are at the cutting edge of new technology. These must be provided first by the scientific and engineering personnel. Workplace training programmes must be relied upon to produce such skills" and only later should these skills be transferred to the educational system. "Such transfer requires closer collaboration between schools and innovating firms than is presently the case".[81]

This kind of training is anticipatory, as is much of the retraining taking place when a firm automates. But "unlike their counterparts in several European nations, neither the unions nor the government have been advocates of anticipatory retraining".[82] Concrete measures could be adopted to facilitate this kind of training, and also to increase the 'fit' between schools, training courses, and the rapidly changing world of work. One possible improvement would be to exchange trainers between industry and educational institutions, another would be to involve the private sector in the public school system;" we must make sure that the change in technology does not outpace the change in our education system and the capabilities of the majority of Americans". Training vouchers could also be introduced as part of a package for unemployment-related support for workers about to be displaced; and for younger people "a nationwide school-to-work transition programme to help bridge the gap between school and work".[83] Also recommended is intervention by Congress to pass "a real unemployment and training bill", to be followed by an increase "in the number of mathematics and science courses required for high school graduates. We can begin the very difficult process of integrating the private sector and the educational community...We are all going to have to join together - labour, government, business, educators - to meet this challenge".[84]

4.3. Interaction among the policymakers

What is striking about the existing programmes in the U.S. is the already high level of interaction and collaboration among policymakers - government, labour, business and educators. Economic agents from different spheres of influence, and with different interests, meet together to make the initial decision to launch a training programme and to oversee its subsequent

operation. We have described a number of programmes which incorporate on-going trade union-industry participation.

An example is the United Auto Workers-Ford programme. The UAW-Ford "approach to assisting the dislocated worker with respect to retraining and re-employment services, and the active workforce with respect to various education and training options" is "not unique or unusual...What is new and dynamic is the spirit, care, and co-operation with which UAW and Ford have approached these problems and the solutions which they have developed".[85] The California Employment Training Panel, another example, depends on continuous interaction among personnel of government, education and training institutions, industry, and trade unions. "Organised labour has taken an active interest in the California programme, serving as the catalyst for developing about one-third of the panel's training projects".[86]

The programme in Johnstown, Pennsylvania has seen the formation of a small business investment corporation, "a multi-million dollar fund to aid new, small business development" because most of the new jobs are to be found in smaller enterprises. Research is also being carried out "aimed at understanding the design and manufacturing needs of high technology industry and to share this information through training programmes and technical consulting".[87] Collaborators in this three-year programme include the area vocational-technical school, regional industries, the University of Pittsburgh at Johnstown, and the regional planning and development commission.

It is fair to point out, however, that there appears to be more collaboration in retraining and upgrading displaced workers than in specific training for programmable automation. "A key ingredient in successful instructional programmes is close co-operation between industry, educators, labour, and government in such areas as skills assessment, curriculum design, equipment acquisition, location of qualified instructors, and job placement. However, in most cases this degree of intersectoral co-operation is left to chance and does not occur".[88]

The legislative underpinning for some of the existing collaboration in training programmes, especially for displaced workers, is the Job Training Partnership Act of 1983. Although it mandates federal government financing, the money is channeled through the state governments to local and regional

private industry councils (PICs) "that assess local needs and establish performance standards for training and retraining programmes funded under the programme".[89] The PICs are thus in a position to elicit the collaboration of other local economic actors, and to tailor training programmes to the needs of local industries.

5. Conclusions and recommendations for further research

The economic restructuring currently under way in the United States concerns many different industries in different ways and degrees. Some industries in industrial decline either close or leave the country for other locations; others stay and automate. Many flourishing industries have introduced new automation technologies. Many workers are affected by these events, both older workers who are being displaced and are in need of retraining, and younger workers who require new kinds of training to accomodate to the rapidly changing needs of employers.

It is unclear what the longer term prospects are for industrial employment in light of the increasingly heavy investments being made in new technologies. What is clear however is that any training or retraining to be done must take account the likely insertion of a large number of workers into at least partly automated workplaces.

But the decision as to whether to retrain, and in what to retrain, is most often left with the worker, who operates with little future forecasting information and little or no knowledge of current job opportunities elsewhere. Workers displaced in a given area may well have the same skills, and be in competition with each other for limited local employment. The retraining programmes available are most usually local or regional and will be limited. They are likely to receive some government money but are mostly administered by joint bodies on which employers hold substantial power, or they may even be totally employer-sponsored. The training opportunities that exist are therefore likely to adapt workers better for the near-term local employment opportunities that may exist, but they do not prepare a worker for a transfer elsewhere where jobs may be more numerous. There is however sometimes good local placement, and some of the training programmes are quite successful. Training for the high technology environment of the future is harder to find and often less successful, since such training faces a number

of problems such as teacher shortages and inadequate student preparation and equipment.

Trainees and employers often find that new workers - including students just out of high school - have unsatisfactory levels of literacy and mathematics and science training. There is little actual skill instruction in secondary educational institutions, although vocational courses are offered in some high schools. Combined with the faculty school preparation in general, it offers an insufficient base for participation in the industrial world. Thus the extensive mass public educational system which has existed for so long in the U.S., and which almost all workers have attended all the way through high school, has serious drawbacks. The public and private post-secondary institutions find they have to do much remedial work before imparting new knowledge. In one instance, the school system of a whole city, the City of Boston, has been encouraged by the areas's private industry council to promise to improve the skills of young people in exchange for a pledge by area businesses to hire them. The agreement, now four years old, is working well; in 1986 ninety-three percent of Boston's high school graduates were either employed or in post-secondary education.

Education and training are the domain of state and local public bodies, whereas trade unions, private employers, and other organisations also engage in training activities. There is much variation from one state and one area to another, and much duplication of effort. There is, however, some advantage in limiting regionally and financially a new programme until it has proven itself, and states and localities frequently use programmes from other areas as models. In all, however, there is a shortage of programmes for both the displaced and for young people seeking training for the new technologies, and overall the training system appears unco-ordinated and haphazard.

Further research might include study of those programmes which are most successful and the mechanics of recruitment, training and subsequent job placement. It is also necessary to find out what measure are being taken to rectify the serious shortcomings of the education system, and to promote education and training geared to both general and particular job markets. Ways could also be researched to strengthen enterprise-based training, and specifically on-the-job training as a form of apprenticeship, which appears to be in decline as employers "farm out" their required training to specialised individuals or institutions as the occasion demands. A particularly important

issue in this regard is to explore the ways in which outside finance can be brought to bear in strengthening this kind of training. The employer's "obligation to train", such as exists in France, or the levy system, which we have seen some Asian countries apply, is not applicable in the U.S. Indeed, U.S. employers either directly or through industry councils have done a remarkable job in promoting training to date, and should therefore be encouraged to continue to do so.

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Conclusion

This short conclusion will mention some of the main features, and some of the similarities and differences, of industrial restructuring currently under way in the four countries discussed in this report and their various education and training systems. We will identify what appear to be the strengths and weaknesses of each system. For more detailed country-specific findings, however, the reader is referred to the conclusion at the end of each country report.

In many respects, the four countries can be ranged along a continuum, with the U.S. and South Korea representing opposite extremes. The U.S. is the oldest industrialised country, South Korea is the newest. The U.S. has the smallest proportion of the workforce still working in agriculture, South Korea has the largest. Restructuring in the U.S. affects numerous declining or depressed industries as well as automating and modernising industries. In South Korea the main thrust of industrial readjustment is overwhelmingly towards the introduction of more advanced technology. Restructuring - and new investment - takes place without government financial intervention in the U.S., whereas in South Korea the government is the principal economic actor.

As for the other two countries, Japan and Singapore, industrialisation is older, more "mature" and more indigenous in Japan than in Singapore, where the relocation of branches of foreign multinationals has been more recent. The restructuring presently occuring in Japan resembles more closely that in the U.S., because there are both declining and rapidly automating industries. Restructuring in Singapore resembles that in South Korea, involving the technological upgrading of existing labour-intensive industries. In Japan, like the U.S. there is no direct government financial intervention, but unlike the U.S. there is intense government policy pressure and a remarkably close relationship between the various government policy making agencies and the business community. In Singapore the government is the primary economic actor in one important sector, the construction trade.

What all the countries share, with the exception of Singapore, is either growing unemployment or impending threat of it, stemming in particular from

insufficient or declining opportunities in the manufacturing sector. Singapore alone has escaped this difficulty. But because its population is small, the country must recruit workers of all levels, and sometimes trainees from abroad. The main relevance of unemployment for our purposes is that no country, except Singapore, finds itself short of people to train. On the contrary, retraining those displaced by restructuring, or likely to be displaced in the future, is a priority.

South Korea and the U.S. are at the opposite ends of the continuum in yet another way. The U.S. has the most decentralised, geographically varied education and training system. South Korea, with Singapore a close second, has the most centralised and tightly government controlled system. Indeed, in South Korea all education is under state control, and all vocational training is under the control of a central administrative unit, VOTMA. There are enterprise-based training centres, but they are overseen by VOTMA. Singapore has joint government-industry training centres which are supervised by the government, and like South Korea the government has very strong influence through its centralised vocational training board. In Japan and the U.S., on the other hand, training is mostly the domain of the enterprises without government supervision. Even in retraining the displaced the enterprise predominates, but in both countries the government offers assistance. Neither country has centralised national training planning and administration. Only in the U.S. does this lack of centralisation extend also to primary and secondary education, which is the task of the states and localities. In Japan, as in the other two Asian countries, school education is the responsibility of the central government.

In all four countries, a high school education has become a virtual sine qua non for entry into the world of work, and now characterises sometimes up to ninety percent of the workforce, women as well as men. It is of course a prerequisite for additional post-secondary training. But several points are frequently raised regarding the educational system. One is whether a high school diploma should really be required for some of the more unskilled jobs done in those industries - still quite numerous especially in South Korea and Singapore - which remain labour-intensive and with low technology endowments. Another question is whether technical and vocational education ought to be given in secondary schools, and whether it is the secondary school's task to train workers for industry. In all countries, except Singapore, the response

seems to be "no", and where technical or vocational training is given in secondary schools it appears not to be taken very seriously by the educational authorities or by the employers. They feel that training is something which occurs after schooling, not during, which should be done by employers or specialised institutes and centres, not the public school system.

A third question raised about the school system is more in the nature of a criticism. In most countries, critics feel that education (up to and including high school) is inadequate compared to its theoretical possibilities - and, in most instances, to the needs of employers for a literate, knowledgeable, flexible and technically adaptable workforce. Serious charges have been levelled at high school education on these grounds, especially in the U.S. and Singapore. In Japan, while it is felt that the schools teach adaptability, employers and businessmen feel they do not encourage creativity. Only in South Korea does there appear to be little criticism, but there is a feeling that the links are inadequate between the needs of industry and the current training and educational programmes. This inadequacy undoubtedly stems from the extremely centralised control over education and training in South Korea and the absence of employer input. The need to train young people in technical skills is not being met, nor is the need to retrain production workers for occupational change in the event they are replaced by automated processes.

One final comment about the educational system. In all three Asian countries, schooling - for all its shortcomings - is considered extremely important by parents, students and employers. There is credential inflation and a high school diploma is important in itself to employers, regardless of how it relates to actual job tasks to be performed. Moreover, employers now increasingly demand more advanced degrees, more often from university than junior college. In general, exclusive importance is given to a potential employee's degrees rather than his or her capabilities. This makes advancement literally impossible for those who have not obtained the "proper" schooling, regardless of their technical or knowledge skills or work experience. This emphasis on formal qualifications seems to be increasing, although some critics feel it is misplaced and even hinders restructuring and industrial development.

Women have a particular and unfortunate situation in regard to schooling, training and employment, especially in the three Asian countries. Here, but

less so in the U.S., advanced technical education and training opportunities for women are scarce even though a majority of women now obtain high school diplomas. Women are largely barred from participating in scientific and technological development of their countries, regardless of their intelligence and capability to do so. They are uniformly assigned low-skill, low-knowledge tasks despite their often high levels of education. In all three Asian countries, women with university degrees are now no longer so uncommon. They do repetitive, technically undemanding work, especially in textiles and electronics, and are an "unemployment cushion" in that they can be easily let go in times of economic downturn; and they are much more often apt to be laid-off than men. In Japan, their role as secondary labour permits employers to restructure while holding onto male workers. In all four countries, the U.S. included, women receive sixty percent or less of the pay of men for similar work. None of the countries studied is taking full advantage of women's capabilities or giving women their share of participation in the restructuring process.

Some countries offer more scope than other for training initiatives by various economic actors, whether in planning of actual delivery. Foremost is the U.S., where there is an extraordinary amount of collaboration between state and local authorities, trade unions, local industry councils and employers. Most initiatives to retrain displaced workers are joint ventures, and they often enjoy federal government financing. Some of these are "experimental" initiatives which could well provide models for other countries as they increasingly attempt to deal with their retraining needs. The U.S. is also unique in the extent of its trade union input into education and training activities.

On the other hand, the U.S. has by no means solved all the problems of training for high technology and reprogrammable automation. Japan and South Korea stand out for their intensive investments in institutes of advanced technology, research centres, etc. Singapore has also been active in strengthening its endowment in this area, but it appears to need less advanced skills and knowledge then the other countries. In fact, it is somewhat unclear precisely what Singapore's training needs are.

Finally we conclude by remarking that of all the countries, Japan stands out for the process of re-evaluation of education and training which is

currently under way. The self-scrutiny of Japan's policymakers, and the rethinking they have embarked upon to improve an already exceptional system is laudable. However, Japan is not the only country which has a strong national commitment to restructuring in the course of economic development and to the full use of education and training to achieve it. That drive Japan shares with the other two Asian countries.